

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

FEBRUARY, 1960

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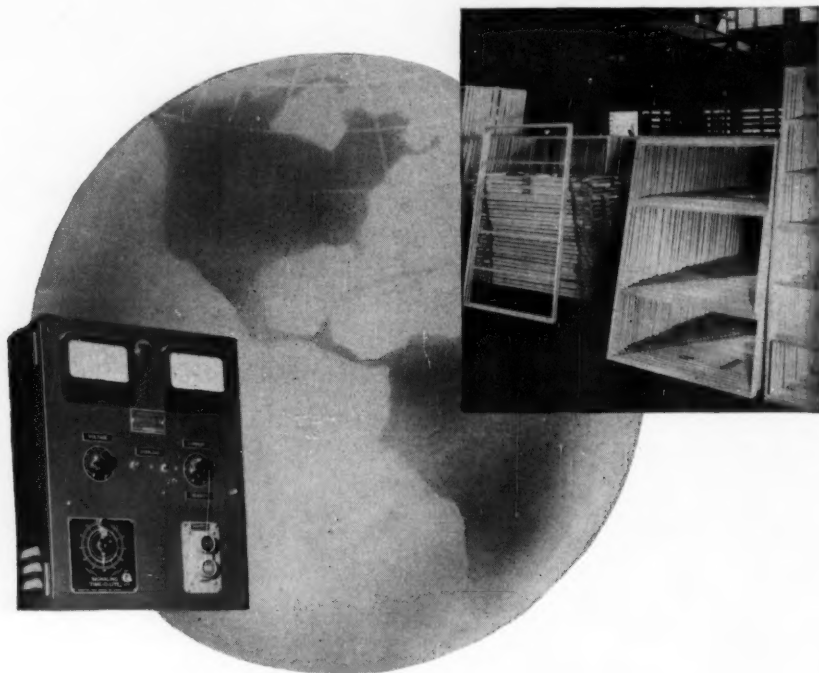
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Read and pass on—



*"There's a world of difference in Anodizing when you have
Automatic Current Control" . . .*

. . . says John Gurniak of

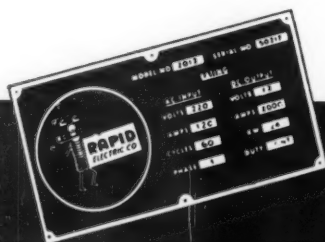
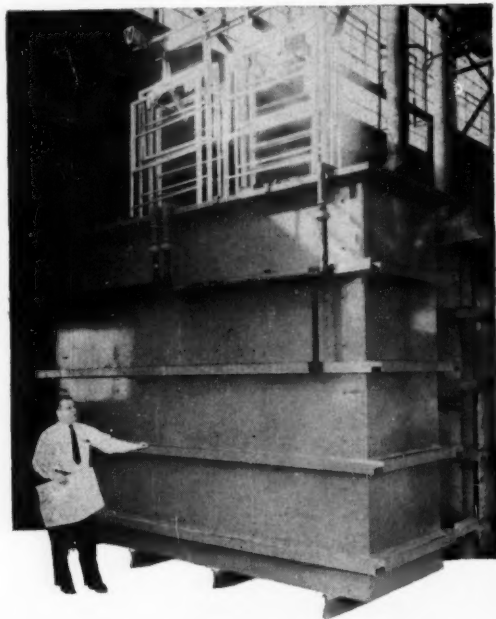
MICHAEL FLYNN MFG. CO., PA.

"and that big difference is the accuracy and simplicity in which a pre-determined film thickness can be controlled."

"We chose RAPID ELECTRIC'S Automatic Current Control rectifiers to eliminate the problem of estimating current densities with each load change. One setting, and the rectifier automatically maintains a constant current density per square foot of work."

"It's that easy".

"Once more, with the possibility of over-current virtually eliminated, MICHAEL FLYNN'S high standard of quality is assured."



THE NAMEPLATE THAT MEANS

"More Power to You!"

RAPID ELECTRIC COMPANY

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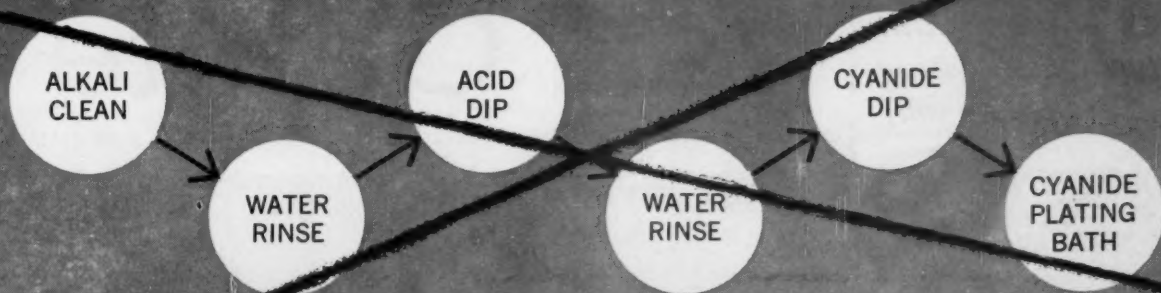
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• Diamond 1-8537

2881 Middletown Road

• New York 61, N. Y.

• TAlmadge 8-2200



ENDOX

*the PATENTED alkaline deoxidizing process
prepares steel for plating
in one simple step!*



In one, simple electrolytic operation, Endox completely removes rust, scale, smut, soil and oxides from steel and activates it for plating. On work that has been precleaned to remove heavy solid soils, no alkali cleaner, acid dip or cyanide dip are required. Endox replaces them all and gives superior plate adhesion, especially on difficult-to-activate alloy steels. Acid attack and acid fumes are eliminated by use of this room-temperature, alkaline process.

Endox cuts rinse water volume (and rinse water waste treatment costs) way down since there's only one brief rinse in the entire cycle prior to plating in a cyanide plating bath. Endox solutions contain sodium cyanide and are compatible with all cyanide plating solutions.

Endox also produces excellent results prior to acid plating baths. It has solved many problems involving adhesion of nickel plate to

malleable iron and alloy steel parts which are later subjected to stress. Prior to acid plating, however, the alkaline Endox residue should be neutralized by a dilute acid dip or "sour rinse".

Endox can be used in both barrel and rack plating lines. Endox solutions are very economical to use because they can be maintained indefinitely by periodic analysis and replenishment, just like a plating bath.

Enthone pioneered alkaline deoxidizing and derusting and first introduced such techniques in 1951. In recognition of this, Patent No. 2,915,444 has been awarded to Enthone. Benefit from our long experience in alkaline pickling; write for literature on Endox and the name of your nearest Enthone representative who will be glad to process sample parts for you. Enthone, Inc., 442 Elm Street, New Haven, Connecticut.

ASARCO

ANOTHER PRODUCT OF *Enthone* RESEARCH

ENTHONE
A Subsidiary of American Smelting and Refining Company

*Which pre-paint
phosphate coating
is best for you?*

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



Undercoat of Oakite CRYSCOAT adds to the looks and life of finishes

From toys to tractors, painted metal products look better and last longer with Oakite Cry-Coat under the paint.

CryCoating—the conversion of a steel surface to a phosphate surface—creates a perfect base for paint adhesion. Paint goes on in a smooth, serviceable coat. Once on, it stays on.

At the same time, a CryCoated surface prevents the formation of rust . . . even prevents rust spreading from a deep scratch. Both metal and paint are safeguarded. The product looks better, lasts longer.

Oakite has a CryCoat process to fit every requirement—for iron phosphate or zinc phosphate coatings, for spray washer or for tanks.

Is your particular problem one of economy? Durability? Production bottle-neck? For a helpful answer, ask your local Oakite man. Or write for details to Oakite Products, Inc., 28A Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



61

..... for 61 years!

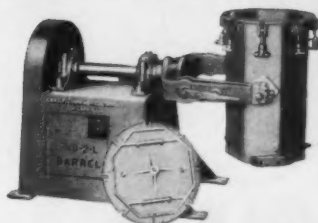
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Plating, Polishing Equipment,
Supplies for Better and
More Profitable Metal Finishing**

Chas. F. L'Hommedieu & Sons Co.



No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.



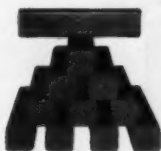
**TYPE L — DOUBLE ACTION BARREL
For ABRASIVE TUMBLING or BALL BURNISHING**

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.



**RELIANCE KUL-KUT BUFFS
FOR FAST CUTTING**



**RELIANCE EXTRUDED
COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"**

THEY CUT • THEY CLEAN • THEY COLOR

- **DURABILITY**
- **PRODUCTION**
- **ECONOMY**
- **EFFICIENCY**

**THE ANSWER TO INCREASED
PRODUCTION AT LOWER COST!**

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NICKEL PENTRATE®

TOPS

**the Black
Finishing
Field**

Five points: (1) faster, more uniform blackening, (2) increased corrosion resistance, (3) increased abrasion resistance, (4) improved appearance, and (5) lower operating costs have established Nickel Pentrate as the leader in black oxide finishing. If you are not fully acquainted with Nickel Pentrate and what it can do for your product or your business, send now for free illustrated bulletin which gives detailed information.



HEATBATH CORPORATION
SPRINGFIELD 1, MASSACHUSETTS

or 701 North Sangamon St., Chicago 22, Ill.

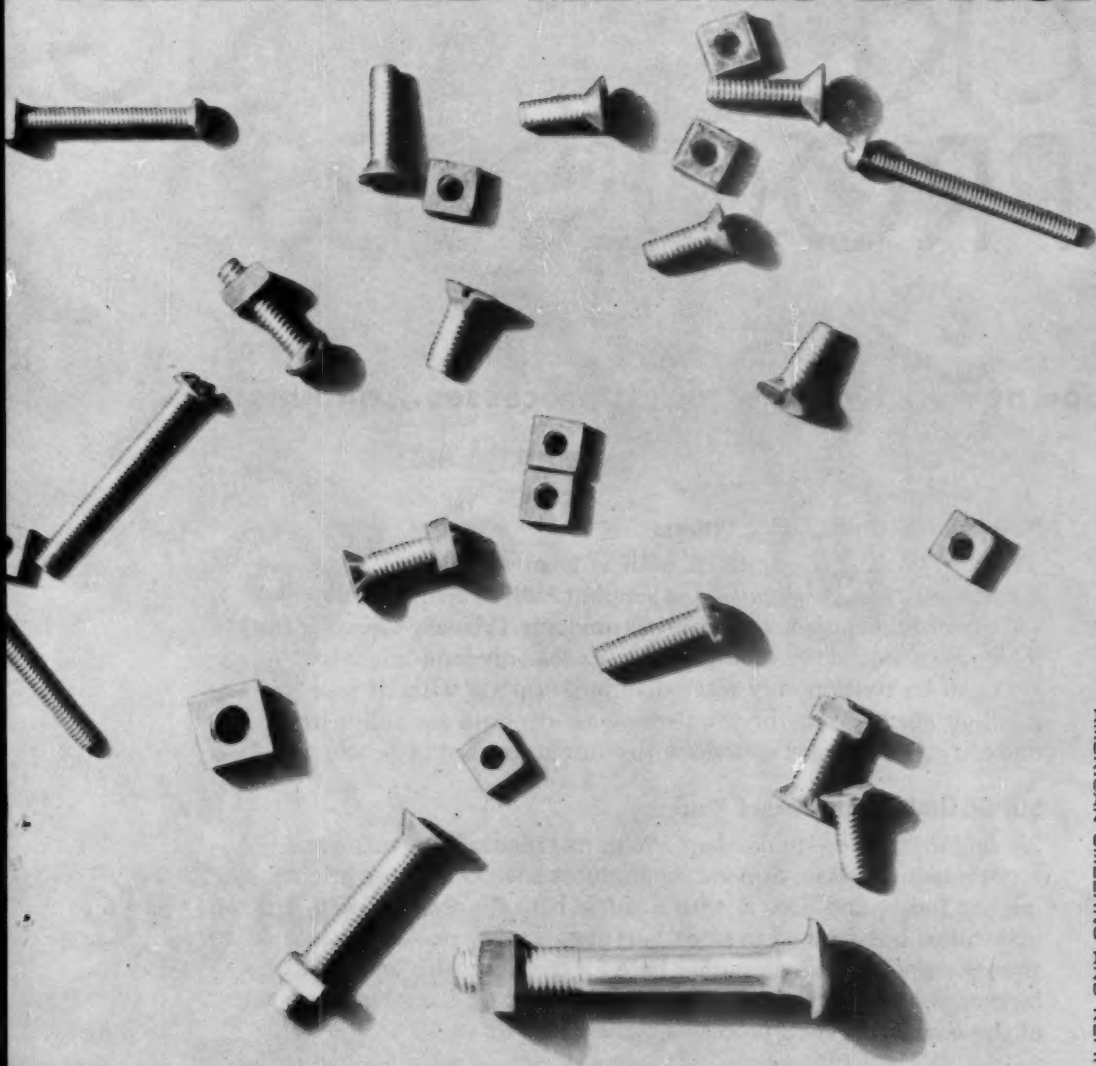
**38 Years of Service to the Heat Treating
and Metal Finishing Industry**

Your finest work starts with Federated Plating Materials: No Federated plating material is approved for marketing before it has proven its quality through continuing Asarco research. Thus top performance is assured.

This policy of research and testing has rewarded the plating industry with Conducta-Core lead anodes which have greater throwing power, yet last three or four times longer than other lead anodes. Cadmax, addition agent for cadmium plating, is another example of superior materials. So too is Zimax for zinc plating, Nimax, a nickel plating brightener, and new Conmax, a conversion coating for cadmium and zinc plated parts. All do a better job at lower cost.

Your Federated representative or distributor will be glad to document this superiority. And you'll prove it for yourself when you standardize on Federated materials. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

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ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Federated products for the Plating shop include ANODES: Copper; lead, including the famous Conducta-Core; zinc, tin, tin-lead, cadmium, brass, silver. NICKEL SALTS: Constant quality control assures full nickel content and identical plating characteristics from every lot. PLATING ADDITION AGENTS: Cadmax for still or barrel cyanide cadmium plating; Zimax liquid or powder; Nimax for low cost bright nickel plating; Conmax, a conversion coating, for cadmium and zinc plated parts.

From **H-VW-M** Research:

2 NEW NICKEL-PLATING PROCESSES

Here's good news...two new nickel processes...and more to come!

PERMALUME Semi-Bright Process

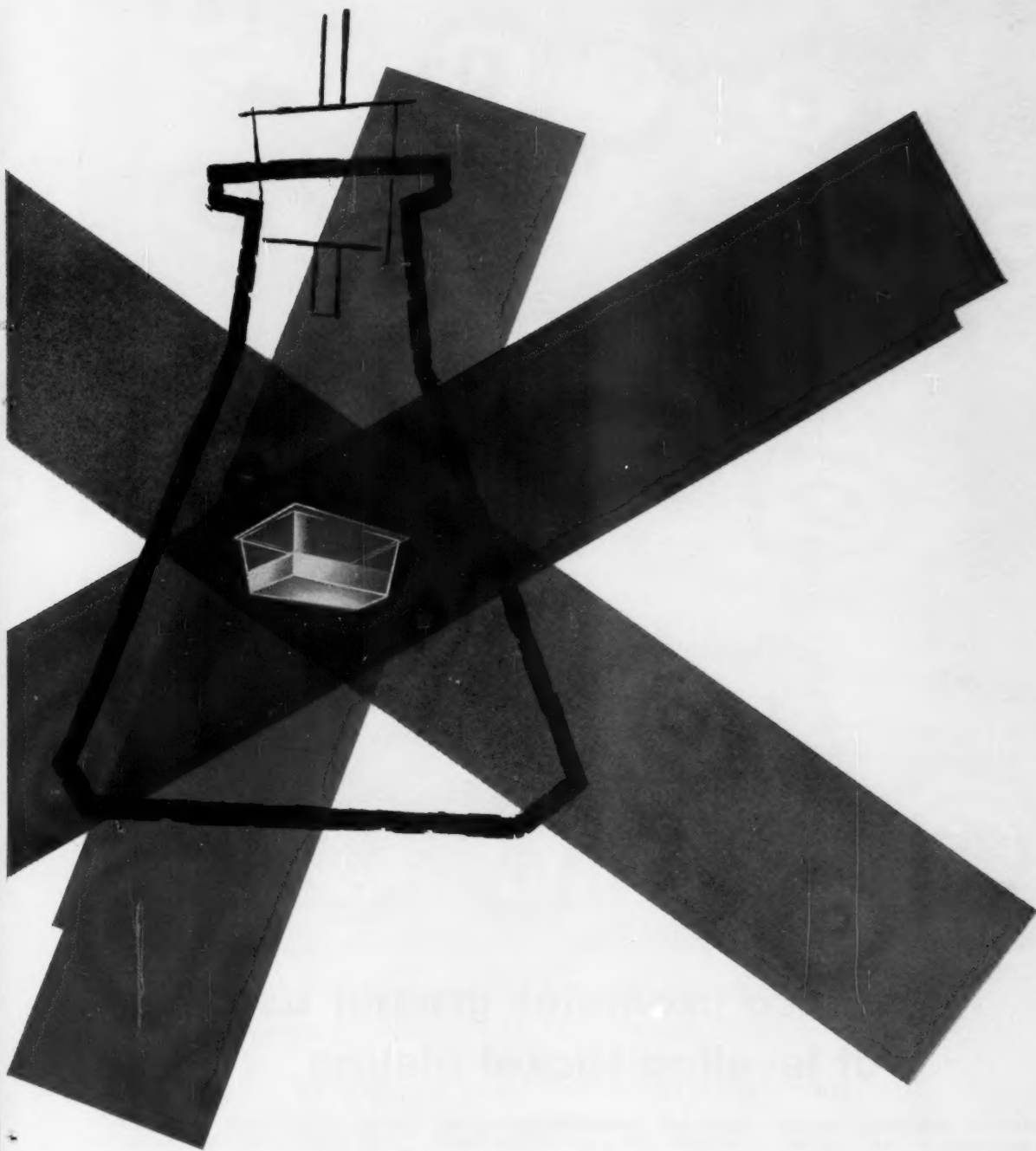
This fast-plating air-agitated bath is ideal for today's duplex-coating systems. *Permalume*, the simplest bath to operate, will not form harmful reduction or hydrolysis products. It is easy to analyze. There is no breakdown in brightness. It's the *only* semi-bright bath that can be continuously filtered through carbon without loss of addition agents! Semi-bright *Permalume* deposits are sulfur-free and are used in duplex systems with a bright top coat of *Levelume*.

SUPERLUME Bright Nickel Process

No brighter finish — in one bath. With its remarkable leveling and scratch hiding action, *Superlume* produces a smooth, super-bright quality finish, and does it with a *single* bath. *Superlume* costs a little more, but pays off in smooth-as-glass quality *plus* impressive time savings. It beats *any* other bath for ductility with leveling at high current density! For detailed information on the advantages of these new H-VW-M processes, write today to:

Hanson-Van Winkle-Munning Company, Matawan, New Jersey.
Offices in Principal Cities.

Alert Supply Company is H-VW-M in the West. Los Angeles • San Francisco



H-VW-M

*Progress in metalfinishing through
advanced processes • equipment*



UNPLATED STEEL BUMPER
(finished with 220 belt)

SAME BUMPER PLATED WITH:
2 mils of leveling Nickel Plating
0.01 mils of chromium plating

Reflections in this bumper section illustrate the rich, mirror-like finish you get with quality Nickel-chrome plating. A layer of leveling bright Nickel plating evened out the surface imperfections on the bare steel visible at left and provided a smooth foundation for the subsequent chrome plating.

How Inco promotes greater use of leveling Nickel plating

In an extensive advertising campaign to *your* customers, we are using two powerful arguments to promote greater use of leveling Nickel plating:

1. **greater economy**
2. **better plating quality**

Full-page advertisements in "Automotive Industries," "D.A.C. News," "Product Engineering," and "Industrial Design," will tell your customers that leveling Nickel plating reduces — even eliminates — polishing before plating and buffing afterwards.

Then these advertisements go on to say that when a second layer of Nickel

is used over a semi-bright leveling coat, the duplex nickel coating that results offers beauty and durability *beyond compare!*

Promotional support like this is just one of the many ways we try to make your job easier and more profitable. Another is the way we are helping to assure continued ample supplies of Nickel for your quality finishes. (Inco's new \$100-million mining development in Manitoba means that in 1961, the Free World will be able to produce more than twice as much Nickel as it consumed in 1958.)

You can plan with Nickel — plan to

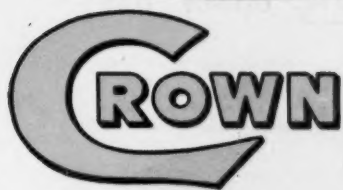
raise plating quality and beauty, to make products more salable. And to help you do this — as part of our program to keep you posted on plating developments — Inco can send you a newly revised technical bulletin designed specifically for platers — "Practical Nickel Plating." Write us for your free copy.

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

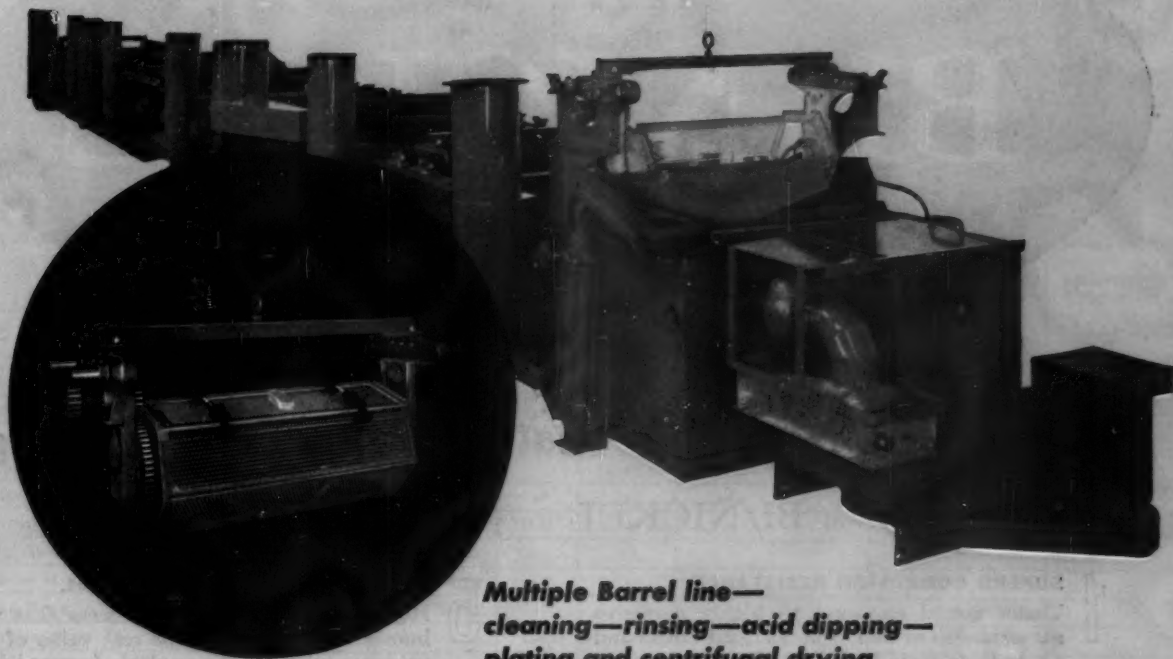


Inco Nickel

makes plating perform better longer



PLATING BARRELS



*Multiple Barrel line—
cleaning—rinsing—acid dipping—
plating and centrifugal drying*

CROWN LUCITE CYLINDERS

Can be operated through the entire cycle
cleaning—rinsing—acid dipping—and plating solutions.

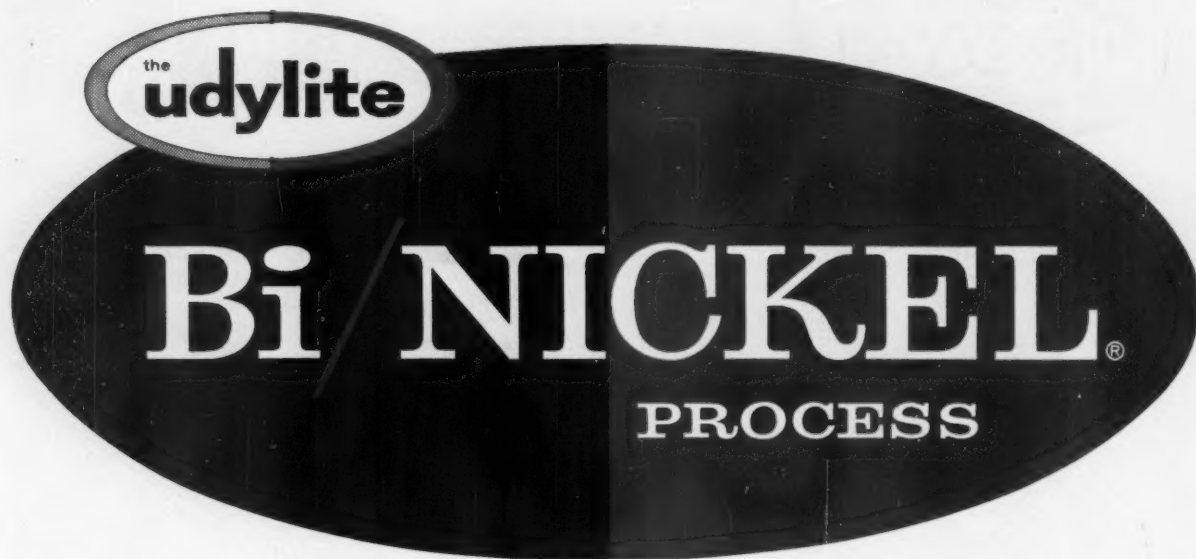
Whether your production requires a single barrel
or a multiple set up for cleaning, rinsing, acid dipping, and
plating, there are Crown barrels to fit the job.

Write for complete details

CROWN RHEOSTAT AND SUPPLY COMPANY

1965 PRATT BOULEVARD • ELK GROVE VILLAGE, ILLINOIS

Yes, there's an answer to corrosion, after all



The combination nickel that's making plating history

only from Bi/NICKEL do you get all these benefits

1 SUPERB CORROSION RESISTANCE

Under actual exposure to highly corrosive atmospheres as well as accelerated CASS and Corrodokote tests Bi/NICKEL has proven its superiority over other bright nickel coatings.

2 THE MOST BEAUTIFUL FINISH

Color and brilliance obtained with Bi/NICKEL incorporating Udylite Bright Nickel, such as the Incomparable 66 and other Udylite nickel processes, cannot be matched.

3 ADHESION PROBLEMS LICKED

Bi/NICKEL offers a solution to adhesion problems previously considered inherent in combination nickel processes. Chrome finishes "take" to Bi/NICKEL with remarkable facility.

4 FULL RANGE OF COMBINATIONS

There is a version of Udylite's Bi/NICKEL which is adaptable to your product and problem whatever the demands of basis metal or the limitations of your already installed equipment.

5 INCREASED PRODUCT POTENTIAL

Here in Bi/NICKEL is a process that will immeasurably enhance the real value of the products to which it's applied. Longer life of usefulness and beauty can be expected from a Bi/NICKEL-Chromium finish. It gives you a real talking point when it comes to sales.

6 ANSWERS CUSTOMER COMPLAINTS

Bi/NICKEL is a step in the right direction toward solution of corrosion problems that have harassed automotive manufacturers and all others where corrosion has been a factor in a product's "life expectancy".

Discover TODAY how the Udylite Bi/NICKEL process is just what you've been looking for to meet and beat your corrosion problem.

you get Bi/NICKEL only from



DETROIT 11, MICHIGAN
WORLD'S LARGEST PLATING SUPPLIER

METAL FINISHING, February, 1960

EFFECTIVE

Pfizer

**CHEMICALS FOR
METAL
FINISHING**

**PLATING
DE-RUSTING
METAL CLEANING
ALUMINUM
ETCHING AND
COLORING**

	Cleaning	Polishing	Pickling	Electroplating	Electropolishing	Non-Electrolytic Depositions	Electrolytic Oxidation	Etching	Gold Coloring of Aluminum
Citric Acid	✓	✓	✓	✓	✓	✓	✓	✓	
Sodium Citrate	✓	✓		✓		✓			
Ammonium Citrate	✓	✓	✓	✓					
Gluconic Acid	✓	✓	✓	✓				✓	
Glucono Delta Lactone	✓	✓	✓	✓				✓	
Sodium Gluconate	✓	✓		✓				✓	
Oxalic Acid	✓	✓	✓	✓	✓		✓	✓	
Ammonium Oxalate	✓	✓		✓					
Ferric Ammonium Oxalate									✓
Tartaric Acid	✓		✓	✓				✓	
Tartar Emetic				✓					
Rochelle Salt			✓	✓					
Cream of Tartar	✓			✓					

Citric Acid...

Nontoxic, mild, yet chemically active against scale and tarnish. Used extensively in the formulation of general metal cleaners and polishes, particularly household products.

Sodium Citrate...

A preferred ingredient in electrolytic nickel baths, resulting in a brighter plate. Also finds wide use in electroplating processes.

Ammonium Citrate...

Especially useful for the removal of rust in near neutral solutions. Extremely mild and safe to handle.

Gluconic Acid...

An excellent sequesterant in alkaline derusting solutions; provides rust-free, clean surface ready for further treatment. Also highly effective in aluminum etching and paint stripping compounds.

Oxalic Acid...

The most effective chemical for use in automobile radiator clean-

ers. Also finds wide use in electropolishing and as an ingredient in general metal cleaners.

Ferric Ammonium Oxalate...

Used extensively in the production of light-fast gold colored aluminum.

Tartaric Acid...

Excellent complexing agent for copper in electroplating.

Tartar Emetic...

Used in electrolytic baths for deposition of silver and antimony alloys on brass, copper and steel surfaces.

Rochelle Salt...

Increases efficiency and yields finer-grain deposit in alkaline copper plating.

Cream of Tartar...

An excellent additive for brass cleaning compounds. Its crystalline structure acts as an effective abrasive in paste polishes. Chemically active against tarnish.

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100 YEARS

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ANNOUNCING

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**AN EXTREMELY LOW-FOAMING GENERAL USE
SINGLE OR MULTIPLE STAGE SPRAY CLEANER
FOR BETTER RESULTS AT LOWER COST!**

- Gives up to three times longer use-life than competitive products.
- Better cleaning through unusually potent penetrants, surfactants and dispersing agents.
- Carries heavy dirt load without re-deposition.
- Higher the concentration, lower the foaming.
- For use on all ferrous and non-ferrous metals except aluminum.
- Used at 100° to 140°F temperatures.
- Easily removes drawing compounds, oils, and greases.
- An effective rust-inhibitor for in-plant use.
- Ideal for use following soak cleaners.
- An easily handled, moist, granular alkali base material.
- Non-Toxic, dustless, non-caking.
- No disposal problem.

Got a problem? Let Northwest's Cleaning Specialists help you.
Licensed Manufacturers { Alert Supply Co., Los Angeles, California
Armalite Company, Ltd., Toronto, Canada

NORTHWEST CHEMICAL COMPANY

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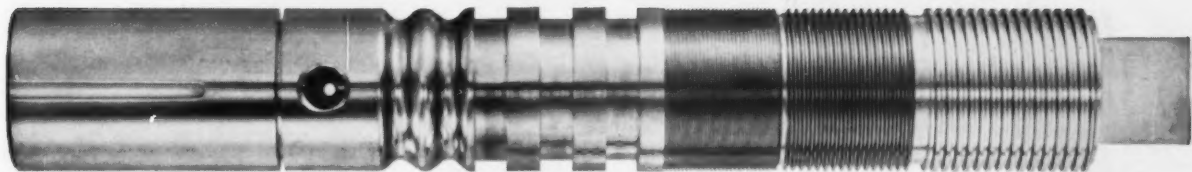


DETROIT 4, MICHIGAN

THEY LAUGHED WHEN WE SAT DOWN TO PLATE...



they didn't know about **KANIGEN®**



This shaft was turned. It was key-slotted, drilled, tapped and shouldered. It was threaded, milled, grooved and chamfered. It was step-bored, with three inside diameters. Who could plate a piece like this all over—inside and out—and expect a uniform coating?

Well, anyone who used KANIGEN® could expect it—and get it. In fact, we made this piece especially to prove it.

The KANIGEN® process for chemical nickel alloy plating produces a uniform thickness of coating, re-

gardless of the contours of a part. This uniformity permits full machining operations prior to coating, with no subsequent cleanup.

KANIGEN® offers corrosion resistance equal or superior to that provided by wrought or electrolytic nickel.

For complete technical details write or call your nearest General American office. Ask for Kanigen Bulletin No. 258. You'll find that with plating as in so many other industrial areas, *it pays to plan with General American.*

**Kanigen Division
GENERAL AMERICAN TRANSPORTATION CORPORATION**

135 South LaSalle Street • Chicago 3, Illinois

Offices in principal cities





Know about Sandoz "bread and butter" dyes?


Trouble-free! Long experience in solving the problems of color anodizers enables Sandoz to assist you in selecting dyes for anodized aluminum which are trouble-free. Here are some of the "bread and butter" Sandoz dyes that require a minimum of control and provide excellent stability in the standing bath, thus resulting in far superior tank life:

Aluminum Gold S	Aluminum Green AX	Aluminum Bordeaux 2R
Aluminum Copper BF	Aluminum Blue A	Aluminum Orange 3A
Aluminum Red RN	Aluminum Violet 3D	Aluminum Yellow 4A
Aluminum Orange 2B	Aluminum Black BK	Aluminum Blue 4A
Aluminum Yellow D	Aluminum Gold EA	

For detailed information and color chips, call or write: SANDOZ, INC., Aluminum Department, 61 Van Dam St., New York 13, N.Y. ALgonquin 5-1700.

SANDOZ

THINKS AHEAD WITH COLOR



HARSHAW NICKEL SULFATE CARRIES GUARANTEED SPECIFICATIONS



Harshaw, the world's foremost producer of high purity nickel sulfate, guarantees specifications from which you derive the following benefits:

1. Consistently high quality material, laboratory tested for use in dull, semi-bright, and bright nickel plating solutions.
2. Product uniformity from shipment to shipment on which you can depend.
3. Harshaw nickel sulfate is high in purity and contaminants will always be well below tolerable limits in your plating bath.

Additional bonus features of Harshaw Nickel Sulfate are . . . Free-flowing, small definite crystals of uniform size . . . Rapid, complete solubility.

We shall be happy to quote prices and provide detailed information upon receipt of your inquiry.

NICKEL SULFATE GUARANTEED SPECIFICATIONS

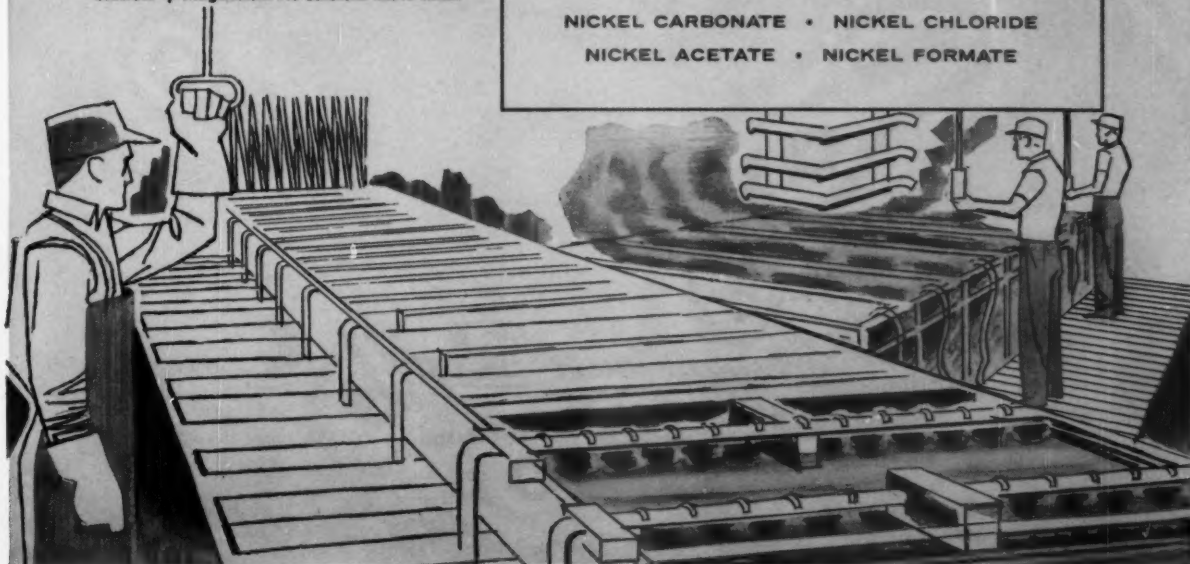
Nickel (Electrolytic Method)	22.0% Min.
Iron	.01% Max.
Copper	.001% Max.
Zinc	.015% Max.
Manganese	.005% Max.
H ₂ O Insolubles	.01% Max.
Calcium + Magnesium As Calcium	.20% Max.

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Other Harshaw Nickel Chemicals
Featuring Guaranteed Specifications
NICKEL CARBONATE • NICKEL CHLORIDE
NICKEL ACETATE • NICKEL FORMATE



WRITE FOR FREE BOOKLET: HARSHAW'S COMPLETE SERVICE TO THE PLATING INDUSTRY



A timely message on
Opportunity is
"how you sees it"
... and how you seize it

by Ben P. Sax

Chairman of the Board, *American Buff Company*

An open mind sees and seizes various ideas and makes them its own for its own devices. Whether it puts them together, improves them, or takes them as they are for new uses, depends upon the individual mind. Every day we see one man's brain-child converted for another man's product . . . to improve its quality or automate its production . . . with corresponding sales and dollar gains.

Creating for the individual the ability to play the organ without knowing a note of music is now an established selling success. The growing scramble of electronic organ competitors pays sure tribute to the sales-power of the original concept.

A new twist to this idea equips a new guitar with "chord dial" which produces the proper chords plus a whole new mass market. The vacuum cleaner idea now helps a new floor-scrubber to suck up its own cleaning solution and dry the clean floor instantly.

Many metal-finishing innovations are examples of how American Buff sees and seizes new ways of doing things better. No doubt our developments, too, will be adapted for advantages in still other fields.

Sincerely,

BEN P. SAX

American **Buff** *Company*

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World's Largest Buff Manufacturer

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TRinity 6-3168

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SUperior 1-6700



A UDYLITE TRIPLE PLAY . . .



ERNIE TO ELLEN TO JOHANNESBURG

Not customary but entirely "in order" is this shipment rushed by Udylite special messenger Ernie Jennings direct to planeside in Detroit, where Pan-Am stewardess Ellen Manners starts it on its way to South Africa. Just 39 hours later delivery is made in Johannesburg, 9036 miles away.

If your problem is as urgent as this, or if you just need quality supplies promptly delivered, you know you can count on Udylite supply services to meet your every demand. Discover how it works yourself. Place your next order with Udylite.

*world's largest
plating supplier*



corporation

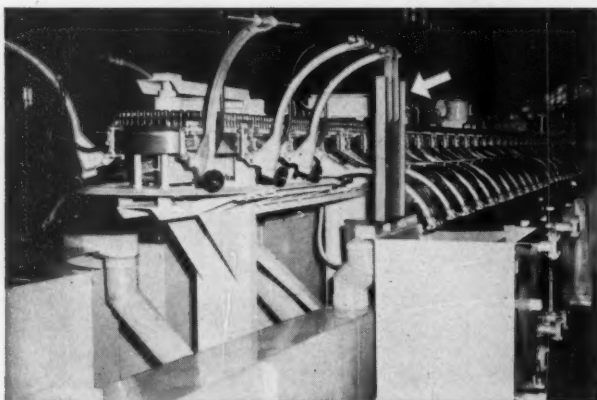
detroit 11, michigan

on the west coast: the i. h. butcher company • los angeles, california

NOW...
there's
a
famous
"LITTLE
STEVE"... ..with

Machine and tanks are easily accessible for service from floor level
... without catwalks or ladders.

VERTICAL LIFT!



Rack size and distance of lift shown by metal plate.

- Offers all the economies of automatic plating on limited and medium-volume operations.
- Permits use of narrower-width tanks for rack plating, thereby reducing space requirements.
- Features smooth, dependable operation and proven design simplicity for which Stevens equipment has long been famous.
- Provides complete application flexibility for electroplating, anodizing, phosphating and other dipping and coating processes.

"Little Steve" in the new, vertical lift model, with the traveling hump cam action, will become an important member of your production plating team. Investigate Stevens' low-cost, automatic plating equipment today!

Remember—when you go automatic ... go **STEVENS!**

frederic b.

STEVENSON, inc.

DETROIT 16, MICH.

BUFFALO

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DAYTON

NEW HAVEN

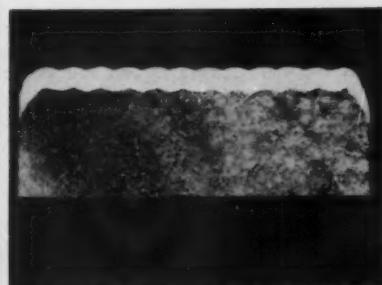
INDIANAPOLIS

SPRINGFIELD (OHIO)

Skilled plater lowers an electrode with Perfect Circle piston rings into a bath of Mutual® Chromic Acid.



Photo shows the Perfect Circle "200" chrome top compression ring (L) and "98" self expanding oil ring (R). The face of the compression ring and the steel rails of the oil ring are plated with solid chrome .004"-.007" thick.



Sectional photomicrograph of the "200" compression ring shows interrupted surface and thick plating of chrome.

FOR PRECISION CHROME PLATING PERFECT CIRCLE USES MUTUAL CHROMIC ACID

Perfection is the goal in producing piston rings. Each is machine tooled to exacting specifications and the chrome plating must be flawless. To safeguard against plating difficulties . . . and expensive rejects . . . Perfect Circle Corporation relies on Mutual Chromic Acid. Like many experienced platers, Perfect Circle knows that careful control, plating skill plus Mutual Chromic Acid add up to a top quality chrome finish.

Mutual Chromic Acid is always 99.75% pure—or bet-

ter. Sulfate content never exceeds 0.1%. Rigid quality control by Mutual insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the acid-sulfate ratio of your plating bath.

To obtain further information about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to offer help or information at any time.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate ■ SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide ■ SOLVAY Methylene Chloride



SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

SOLVAY PROCESS DIVISION
ALLIED CHEMICAL CORPORATION
61 Broadway, New York 6, N. Y.

9-20

- ☐ Send Bulletin 52, "Chromium Chemicals"
☐ Have a representative phone for appointment

Name _____
Position _____
Company _____
Phone _____
Address _____
City _____ Zone _____ State _____

Two New Heavy Duty Portable Filters by Industrial

CORROSION RESISTANT

Note these features:

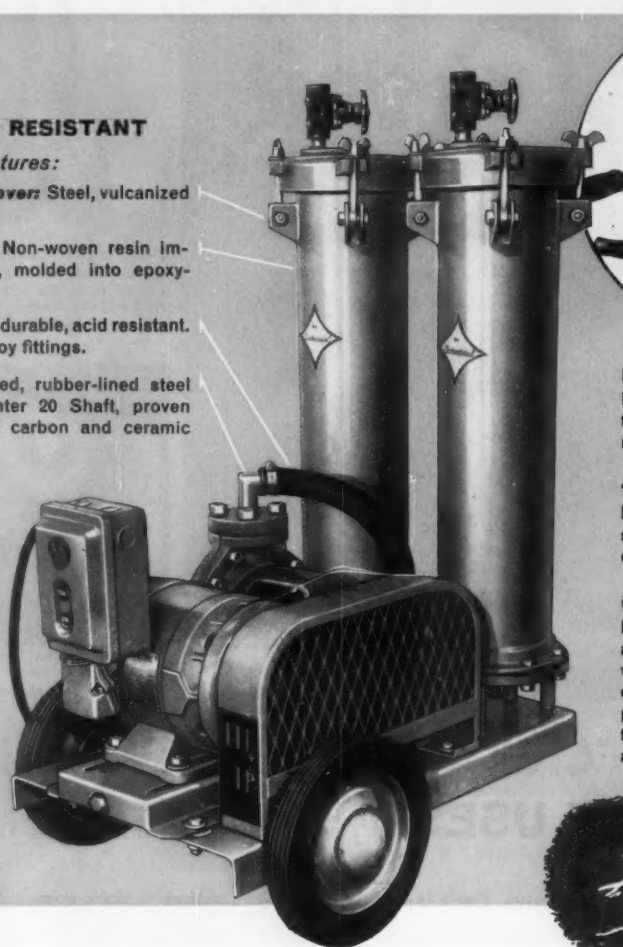
Chamber and Cover: Steel, vulcanized rubber lining.

Filter Element: Non-woven resin impregnated fabric, molded into epoxy-phenolic ends.

Hose: Three ply, durable, acid resistant. Plastic or Hastelloy fittings.

Pump: Vulcanized, rubber-lined steel chamber. Carpenter 20 Shaft, proven mechanical seal; carbon and ceramic components.

1200 GPH



EASY TO CLEAN

Flip-top cover lifts off. Pull-out cartridge can be replaced or rinsed and reused in seconds.

100% PORTABLE

Mounted on two 6" dia. wheels. Full swivel rear coaster insures complete ease of movement.

COMPACT

Is complete filtration system: suction and discharge hose, ball check foot valve strainer; motor with thermal overload starter, filter element(s) and pump... yet requires only 6 sq. ft. of floor area. You simply plug it in... and start filtering, anywhere.



Now you can eliminate the time and expense of bothersome repiping and the need and equipment for separate plating solution filtering stations.

The new type 118 *heavy duty* Industrial filters are rugged, but compact; low in cost but typically *Industrial-engineered* and rubber-lined throughout for corrosion resistance. The heavy duty *Industrial* pump is of the same long proven design employed in hundreds of *Industrial* filters now in plating service.

Look at the features... look at the specs... look at the *work* capacity. You can get this complete, proven-dependable filtration system in but six *portable* square feet of work area.

WRITE FOR BULLETIN 118.



TWO MODELS AVAILABLE

Single tube 600 gph capacity, is convertible to double tube 1200 gph capacity model shown above.

600 GPH



CHECK THE SPECS:

- 600 and 1200 gph capacity
- 15 and 30 sq. ft. filtration area
- Temperatures to 170° F.
- Unit 50 P.S.I.G. operating pressure
- Fully proven in plating use

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Avenue, Cicero 50, Illinois

INDUSTRIAL

T-859



Now, one grade of trichlor does both

Whether you clean a rocket or degrease a gear, you can now use Nialk® metal degreasing grade trichlorethylene as your cleaning agent.

This grade of Nialk meets rigid government and industry standards for solvents used to clean rocket and missile components. It leaves little or no residue when it evaporates. At the same time, it keeps the above-average chemical stability needed for vapor degreasing.

The savings in this twofold use of one grade of trichlor can be readily seen. Now you can:

Cut your inventory and make your buying easier.

Avoid errors. No one can pick the wrong drum when you're buying just one grade of trichlor.

Make your materials handling easier.

Help end your disposal problems. Usually you can use the Nialk trichlor from your flushing operation in your vapor degreasing operation without distilling, or the solvent can be recovered and used again and again.

STABILITY WITH psp

You get **psp** too, when you ask for Nialk trichlorethylene. **psp** is "permanent

staying power," the ability of the stabilizer to keep from wearing out.

You can get more information on this metal degreasing grade of Nialk trichlor. Just write for specifications and data.

HOOKER CHEMICAL CORPORATION

1302 UNION STREET
NIAGARA FALLS, N. Y.



Sales Offices: Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass.

In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

*For Every Metal
Finishing Waste!*

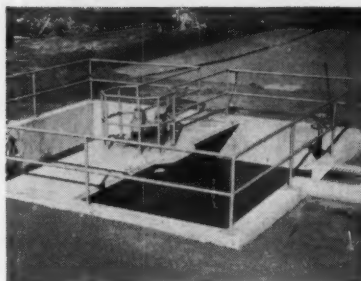
*For Any Degree
of Treatment!*

*And for Chemical and
Water Recovery or
Pollution Abatement!*

INFILCO
Has the Equipment!



57441



VORTI® Mixers

1. Low Power Consumption due to efficient rotor design.
2. Trouble-free operation with no under water bearings.
3. Adapted for rapid mixing, or flocculation.
4. Can be installed in round, square, or rectangular basins.

Bulletin 700



Chemical Feeders

A complete line for solution, slurry, dry feed, and lime slaking. Adaptable for constant rate operations or proportioning by flow or pH control.

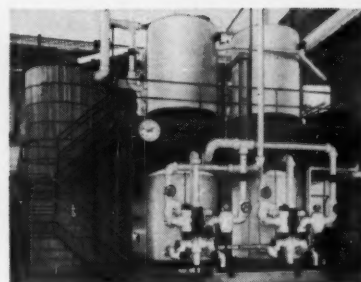
Request Information



CYCLATOR® Clarifier

For clarification and precipitation of toxic metals. Controlled slurry recirculation results in better treatment at higher flow rates. Custom designed skimmers available when needed.

Bulletin 850



CATEXER® ANEXER® Ion Exchangers

recover chemicals and rinse water in many cases. For chromic acid purification and many recovery applications. Each problem is evaluated to determine the economics of recovery operations with the equipment custom engineered for each application.

Bulletin 1960

INFILCO will help you and your engineers evaluate any metal finishing waste disposal problem

Let us help you find the *best* way to meet your particular needs—the one combination of equipment for most economical results. Write for Bulletin 80 to acquaint you with the complete line of INFILCO equipment—
for every type of water and waste treatment problem.

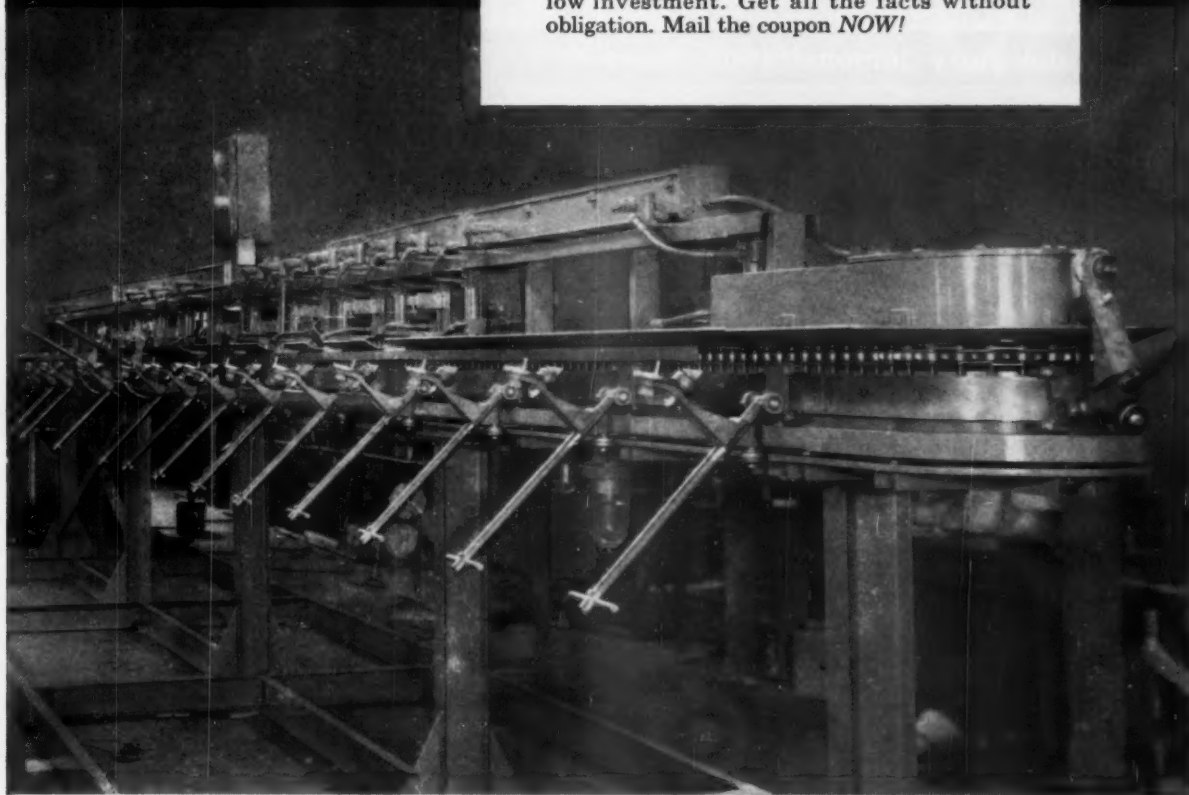
THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

Select-O-Matic

MULTIPLE PROCESS PLATER

Up to 5 or more
process cycles
...at the same time
...on one machine
...automatically!

- ✓ Fully automatic plating at its best . . . efficient, convenient, profitable!
- ✓ A single Select-O-Matic plater carries any variety of work pieces completely through 2, 3, or any other number of process cycles simultaneously.
- ✓ The operator, at the loading station, simply sets a dial on each carrier to select the process cycle for individual racks. The rest is entirely automatic while the racks travel from start to unloading.
- ✓ With a Select-O-Matic, different machines for each cycle are unnecessary. Saving in equipment is tremendous. Maintenance is cut to a fraction. All the floor space saved can be put to more productive use.
- ✓ No matter what your type of operation, Select-O-Matic is easily adaptable—at a surprisingly low investment. Get all the facts without obligation. Mail the coupon NOW!



LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 2805 Allen St. • Dallas, Texas • RIverside 7-8093

ATTACH TO COMPANY LETTERHEAD

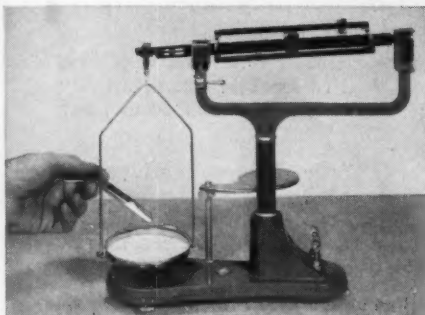
Let us have information on the fully automatic Select-O-Matic.

Name.....

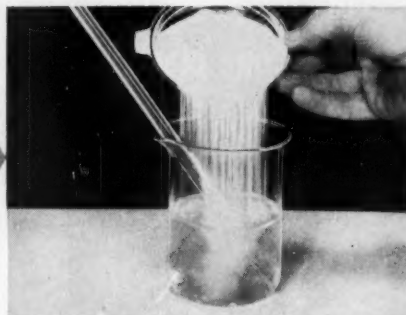
Title.....

Here's how you can save time, and mixing errors with either

New "Direct-Route" Method



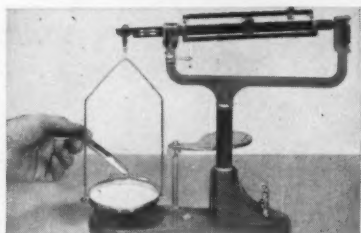
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

Laboratory demonstration shows how "direct-route" method saves time

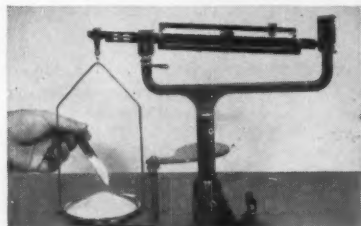
Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.



2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.



4 Add copper cyanide to water and make a slurry.



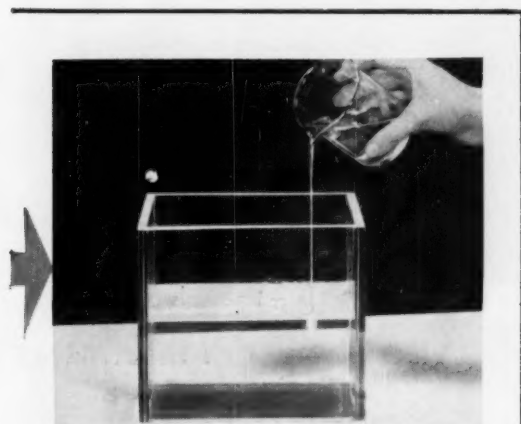
5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

CALL DU PONT FOR ANY ONE OF THESE QUALITY PLATING PRODUCTS. You're assured of superior quality, dependable supply and expert technical service with plating chemicals from Du Pont... your reliable domestic source.

- Sodium-Copper Cyanide Double Salt
- Potassium-Copper Cyanide Double Salt
- Copper Cyanide

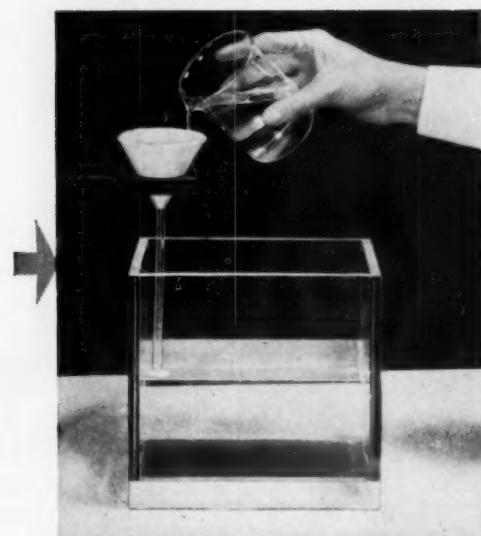
- Potassium Cyanide
- All-purpose Cyanobrik® sodium cyanide (in briquette form)
- Cyanogran® M sodium cyanide (in granular form)

reduce handling, avoid waste of Du Pont's Double Salts...



3 Add directly to plating tank—no filtering necessary.

... avoids errors.



6 Add solution through a filter to plating tank.

DISTRICT OFFICES:

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Waltham 54, Mass.
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NEW YORK 1 350 Fifth Ave.
PHILADELPHIA, 308 E. Lancaster Ave.
Wynnewood
SAN FRANCISCO 24 1485 Bayshore Blvd.

Export Division, Du Pont Building, Wilmington 98, Delaware

SODIUM-COPPER CYANIDE OR POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath... prevents waste resulting from undissolved copper cyanide.

INCREASE CONVENIENCE AND SAFETY...With just one salt to dissolve you minimize handling steps. This means greater convenience—more safety.

Du Pont sodium-copper cyanide double salt and potassium-copper cyanide double salt are white, crystalline and readily soluble. They are made from ingredients of highest quality and purity—Du Pont copper cyanide, sodium cyanide and potassium cyanide.

SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

For further information or Technical Service call your Du Pont distributor or your nearest Du Pont office, listed at left.

ELECTROCHEMICALS DEPARTMENT • SODIUM PRODUCTS DIVISION
E. I. DU PONT DE NEMOURS & CO. (INC.), WILMINGTON 98, DELAWARE



BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

The New **STUTZ** Plating Barrels

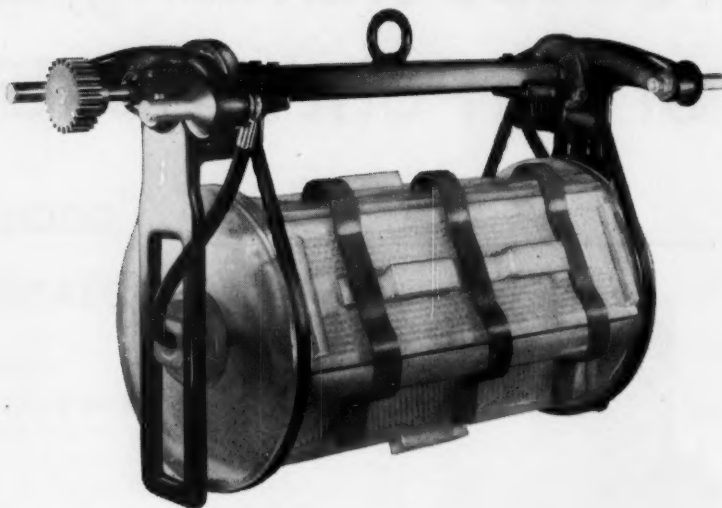
Low headroom design

New materials

Stutz complete cycle assembly for operation in tanks with driving mechanism located externally. Lifting and lowering of unit reduced to a minimum. Cylinder is totally submerged in operation. Belt drive is positive timing design and belts can be changed if necessary in seconds without tools. Saddle horns are located on 15" centers. Cathode contactors dangle type standard, other types available. Cylinder hangers are cast steel protected with special hard rubber or fused vinyl chloride.

Cylinders can be supplied in special sizes, partitions if necessary and special cathode contactors as required.

Barrel assembly units are made to fit all makes of tanks.



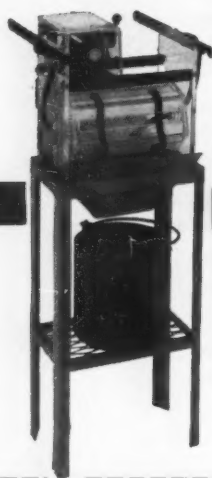
... PLEXIGLAS • POLYPROPYLENE • TEMPRON • MELAMINE ...

Cylinder rotation in this design is provided by motor drive mounted directly in super structure bridge member. Total weight and overall height has been greatly reduced. Handling therefor is fast and smooth. Cylinder transported from one operation to the next under continuous rotation. In this manner solution dragout is reduced to a minimum. Rinsing time following alkali cleaning, acid pickling, etc., is greatly reduced. Overall dimensions of tanks is lessened by the elimination of motor drive platform. Electric service 440, 220, or 115 volt with grounded cable and Hubble-lock heavy duty safety connector.



Sizes 12" to 18" inside diameter—24" to 42" long — perforations 3/32" standard.
All other sizes available.

Tanks in single and multiple—Power equipment—dryers—filters—heat exchangers—chemicals—anodes—ventilation, etc.



Also Adaptable for Tanks Other Than Ours.

STUTZ Portable Plating Barrels

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x20" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

- Baskets in perforated metals or wire mesh.
- Load/Unload Stand for convenient and fast handling of work load.

The *Write for Catalog and Prices*

STUTZ Company

We Invite your Inquiries

4430 West Carroll Ave. Chicago 24, Ill.

COMPLETE METAL FINISHING EQUIPMENT AND SUPPLIES

Some of
the Many
CLEPO
Tumbling
Compounds
Available

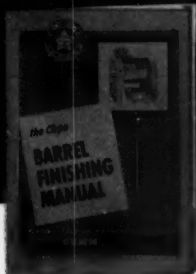
HOW TO CHOOSE AN ABRASIVE TUMBLING COMPOUND

Whatever your abrasive tumbling application, here's how to select the exact compound to meet your requirements:

1. Choose from a broad line of compounds developed by barrel finishing specialists.
2. Have a barrel finishing expert work with you to assure top product performance in the application.

When you buy a CLEPO abrasive tumbling compound, you get both:

Special compounds for unusual requirements are designed in the Gumm testing and research laboratories and barrel-tumbling pilot plant.



For complete data on barrel finishing, 20-page CLEPO Barrel Finishing Manual available on letterhead request.

CLEPO 171-A

For polishing hardened steels to produce extremely low microinch finish

CLEPO 14-W

For light cutting and removing fine burrs from brass or copper

CLEPO 14-R

For medium cutting and deburring of steel, brass, copper

CLEPO 205-J

For fast cutting of the hardest steel and alloys

CLEPO 214-A

For long heavy grinding of sand castings and steel

CLEPO 19-D

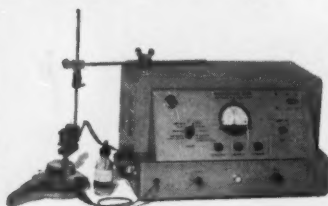
For rough cutting steel to produce heavy matte finish

FREDERICK

GUMM

CHEMICAL COMPANY INC.
538 Forest Street, Kearny, N. J.

Thickness Testing . . . Analysis, and pH made simple with **KOCOUR TEST EQUIPMENT**



- direct reading
- virtually automatic
- 90-95% accurate
- simple operation

Test composite coatings . . .

CHROMIUM-NICKEL-COPPER

Individual thickness readings

No need to use approximations or lengthy chemical methods to determine composite coating thickness. Model 955 determines the thickness of each layer with separate readings of actual thickness for each coating. This is one of the many applications of the Kocour Electronic Thickness Tester. Operation is simple and automatic . . . 90-95% accurate . . . direct readings. Write for Bulletin 400.

Control your plating solutions regularly with **KOCOUR TEST SETS**

Regular control is not only convenient, but you save time . . . avoids delays and shut down, and prevent trouble, KOCOUR TEST SETS provide the best and most direct methods of control. They are complete . . . simple to use . . . no knowledge of chemistry required . . . calculations are minimized.



Whatever your needs . . . KOCOUR TEST SETS are available individually or in economical combinations for the control of plating, cleaning, pickling, anodizing, sealing, coating, passivating, desmutting, deburring, phosphorizing, heat treating, pH control and thickness testing. Write for your FREE copy of "Lab Hints for the Plater."

• KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
Write today for complete information — no cost or obligation.

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CHICAGO 32, ILLINOIS
Specify KOCOUR test sets from your supplier.

Another **FINE** Product
made **FINER** . . .



with the **PARAMOUNT** Finishing Touch

"A fine finish is essential on our stainless kitchenwares," says Vita Craft Corporation.

"One of the most critical steps in our finishing operation is smoothing out and blending in the welds around the ferrules. Paramount Felt Wheels with a tripoli mixture are ideal for this operation because they have an affinity for compound, follow curves easily and produce a smooth finish faster than any other wheels we have used."

Join the manufacturers who depend on Paramount Felt Wheels for "the finishing touch that sells" —

call your Paramount Supplier today!

Paramount

Felt Wheels
Bobs, Sheet Felt

Bacon Felt Co.
437 West Water St., Taunton, Mass.





it's in the bag!

Nickel Sulphate
Nickel Chloride
Nickel Carbonate
Nickel Acetate

- * **CERTIFIED PURITY AND QUALITY** — Only Nuodex "lays it on the line," with an exact *certified* analysis of every batch, attested to by the Quality Control Chemist. This certification appears on every bag of Nuodex nickel plating chemicals shipped to you.
- * **THE FULL MEASURE OF METAL YOU PAY FOR** — The specifications and certification on the label are your assurance that you get *all* the nickel content you pay for. For example, Nuodex stipulates no release of nickel sulphate without a minimum 22% nickel content.
- * **100% VIRGIN NICKEL METAL FINES** — All Nuodex nickel plating chemicals are manufactured from virgin metal ores. No recovered, reprocessed or scrap nickel is ever used, to assure you the absolute minimum of impurities.
- * **PROTECTED SOURCE OF SUPPLY** — The virgin metal used in Nuodex plating chemicals comes from an independent Canadian source. This is your insurance against possible future shortage.

When you buy Nuodex you *know* what you're getting . . . and you *get* all you pay for. Quality controlled . . . value certified, Nuodex nickel plating chemicals are used with confidence—always.

Buy the best . . . it costs no more.

NUODEX

special purpose chemicals for industry

NUODEX PRODUCTS COMPANY • ELIZABETH, NEW JERSEY
A Division of Heyden Newport Chemical Corporation

Fungicides • Nickel Salts • Organic Peroxides • Paint Additives • Stearates • Vinyl Additives



BUYING 99+% NICKEL?

Here's why you should

CHECK WHAT'S IN THE... 1%

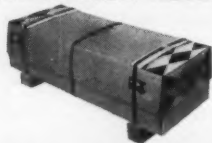
Of course, you, as a nickel user, want 99% pure nickel anodes . . . but, it's that 1% that makes the difference between good and bad plate.

At Allied Research, we make sure that 1% gives you a better performing, more economical anode, for fast, smooth, low-cost and efficient plating.

Here's how:

1. All our nickel anodes are cast from 100% electrolytic nickel—free from harmful contaminants.
2. Carbon and silicon are carefully added to assure you of even, constant corrosion rate and faster, smoother plating.
3. Copper and iron are kept to a minimum—well below the most rigid specifications—eliminating excessive brightener consumption, down time or rejects.

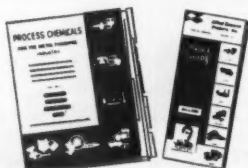
NEW ALLIED RESEARCH ANODE PAK



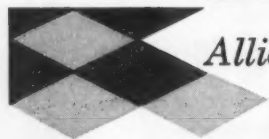
Sturdy, corrugated cartons keep your anodes clean, uncontaminated—ready to use. Paks make handling, storage and inventory easier, too.

NICKEL RECASTING SERVICE

Your nickel butts and spears recast under the same rigid controls. For really substantial savings, get details on our Nickel Recast Blanket Purchase Plan.



For full information on Allied Research Nickel Anodes, Anode Pak or our Nickel Recasting Service, contact your Allied Field Engineer. He's listed in the yellow pages under "Plating Supplies". Or, write for **FREE TECHNICAL DATA FILES**.



Allied Research Products, Inc.

Chemical and Electro-chemical Processes, Anodes, Rectifiers, Equipment, and Supplies for Metal Finishing

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BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butler Co.

IRIDITE®
Chromate
Coatings

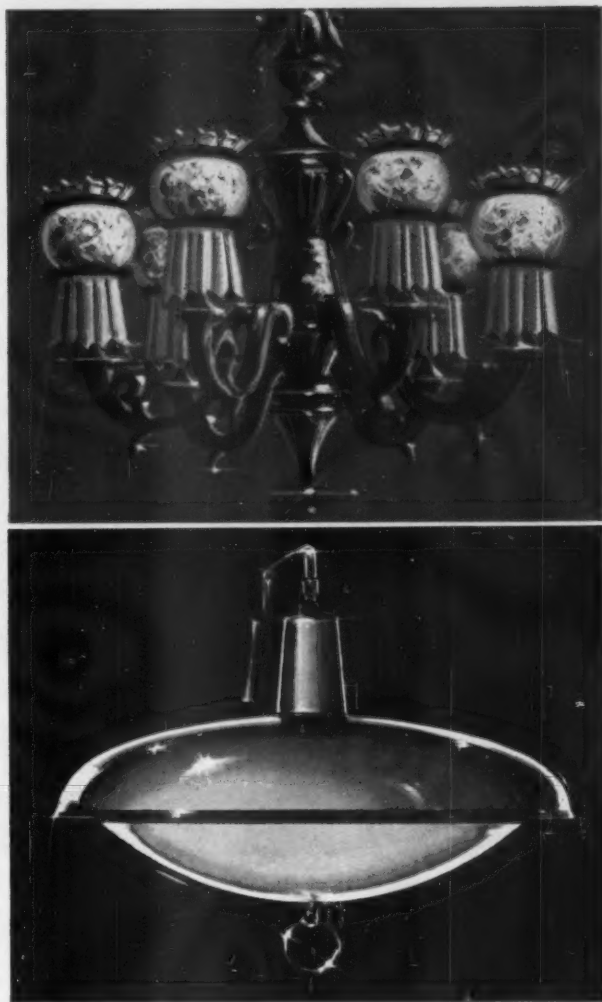
IRILAC®
Clear
Coatings

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ARP®
Chemicals &
Supplies

WAGNER®
Line of
Equipment

Since
the days of
the ornate
chandelier



A shining, luxurious chandelier was much admired back in 1910. Its lustrous finish added elegance to any room. But that luster caused manufacturers plenty of problems—finishing problems that had to be solved efficiently and economically. For the solutions, manufacturers turned to Acme. And they're still relying on Acme engineers for the answers.

Reduction of costly rejects, increased volume of production, complete machine finishing of odd-shaped pieces . . . these

are a few of the solutions Acme engineering has provided.

Today Acme progressive engineering builds equipment to polish and buff metal faster—and better, too. And at lower cost, because Acme engineers combine standard units with a wide variety of accessories to make *custom* machines.

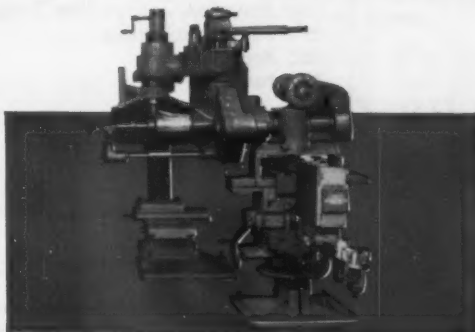
Every year of its history, Acme has solved new finishing problems for many industries and manufacturers. Let us help you solve *yours*.

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

Acme special semi-automatic machine with E-10 oscillating fixture arrangement used with Acme G-3 buffing lathe. One operator normally handles two units for most efficient production.



LET ACME
Polish Off
YOUR
FINISHING
PROBLEMS



In response to popular demand, we have organized a Convention Train to be known as the "Metal Finishing Special" on the Santa Fe Railroad from Chicago to Los Angeles. Through sleeping cars on the Erie Railroad out of Hoboken, N. J. will be available and will be attached to the Convention Train which departs from the Dearborn Station in Chicago on Thursday, July 21st.

All day Saturday, July 23rd will be spent touring the Grand Canyon.

The round trip fares provide for an attractively priced family plan and return can be made from Los Angeles on any railroad. The fares quoted will apply returning by all direct routes. For those returning via Canada, there will be a slight additional charge.

SCHEDULE OF FARES

Chicago to Los Angeles via Grand Canyon (Inc. Tax)

First Class Round Trip Fare	\$162.53
Family Plan	
Husband and Wife	261.31
Each Additional Family Member	
Age 12-22 Add	98.78
Age 5-12 Add	48.29

One-Way Pullman Fares

Roomette	46.09
Single Bedroom	62.48
Double Bedroom	72.38
Round Trip Coach Fare	121.88

Family Plan Coach Fares

Husband and Wife	193.77
Each Additional Family Member	
Age 12-22 Add	71.89
Age 5-12 Add	35.97

New York to Los Angeles via Grand Canyon (Inc. Tax.)

Train leaves from Hoboken, N. J.

First Class Round Trip Fare	\$252.18
Family Plan	
Husband and Wife	397.49
Each Additional Family Member	
Age 12-22 Add	145.31
Age 5-12 Add	72.66

One-Way Pullman Fares

Roomette	60.06
Single Bedroom	81.51
Double Bedroom	94.45
Round Trip Coach Fare	181.12

Family Plan Coach Fares

Husband and Wife	287.22
Each Additional Family Member	
Age 12-22 Add	106.10
Age 5-12 Add	53.08

In order to make the necessary arrangements, if you are interested in the Special Convention Train, please fill in the coupon below and return to us as soon as possible.



Los Angeles Convention Train
c/o Metal Finishing
381 Broadway
Westwood, N. J.

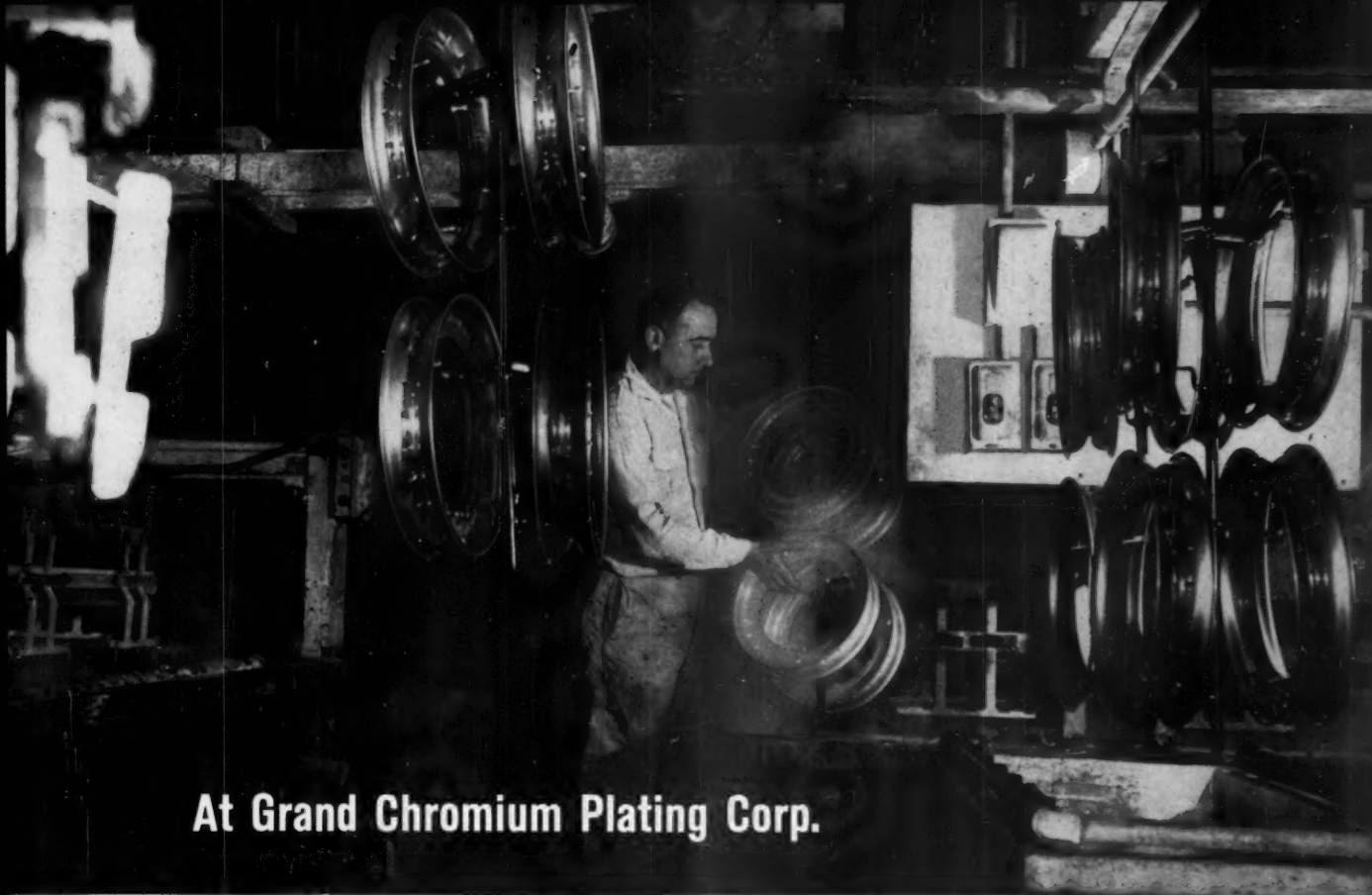
COUPONS MUST BE RETURNED
BY MARCH 1

I plan on attending the A. E. S. Convention in Los Angeles and am interested in taking the Special Train. My party will consist of

Name

Address

City Zone State



At Grand Chromium Plating Corp.

Copper Anode Consumption Reduced 20% with OFHC Anodes

Denser, more uniform copper deposits from OFHC Brand Anodes in a copper cyanide plating bath cut anode consumption 20% at Grand Chromium Plating Corporation of Brooklyn, New York. Plating over raw steel surfaces, Grand Chromium discovered that OFHC Anodes minimized the heavy preparatory buffing of rough areas as well as final buffing of plated parts required when using other anodes. With OFHC, only superficial buffing of "orange peel" was necessary and final buffing was drastically reduced. As a result, they ended up with the same amount of copper on their plated parts, using thinner initial deposits—cutting anode consumption 20%. Other benefits Grand Chromium derived by using OFHC Anodes were:

- less copper lost in solution
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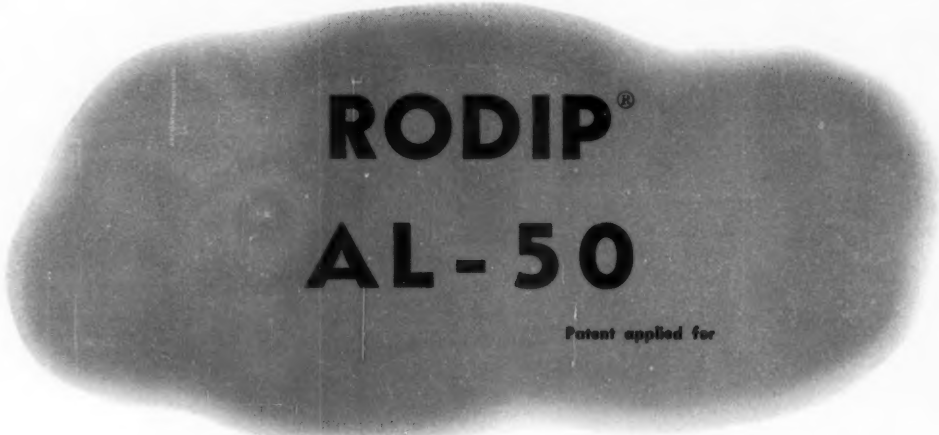
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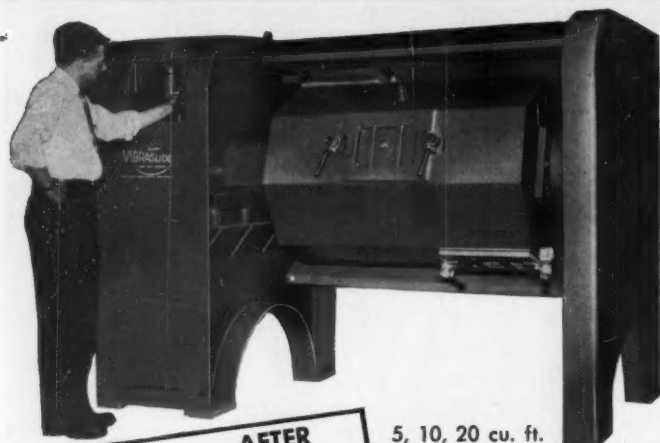
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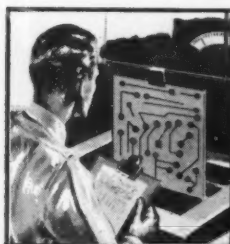
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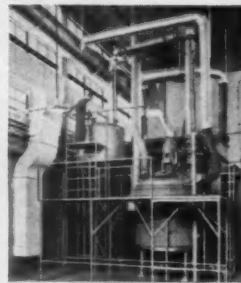
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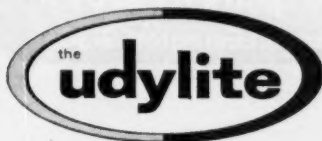
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February 19-20
Ben Franklin Hotel Philadelphia, Pa.

Cincinnati Branch
Sixth Tri-State Regional Meeting
April 23
Sheraton-Gibson Hotel Cincinnati, Ohio

Bridgeport Branch
Twenty-First Annual New England Regional Meeting
April 23
Hotel Statler Hartford, Conn.

Southern Tier Branch
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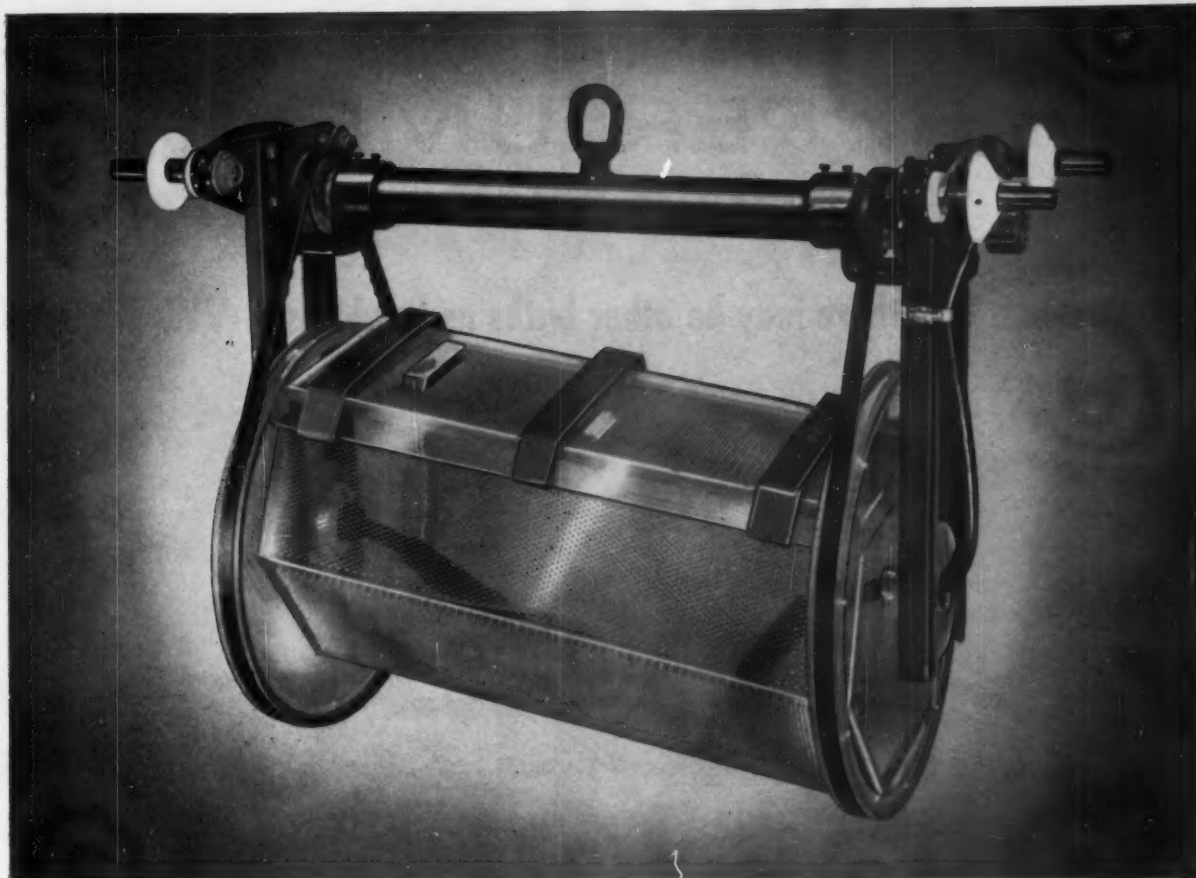
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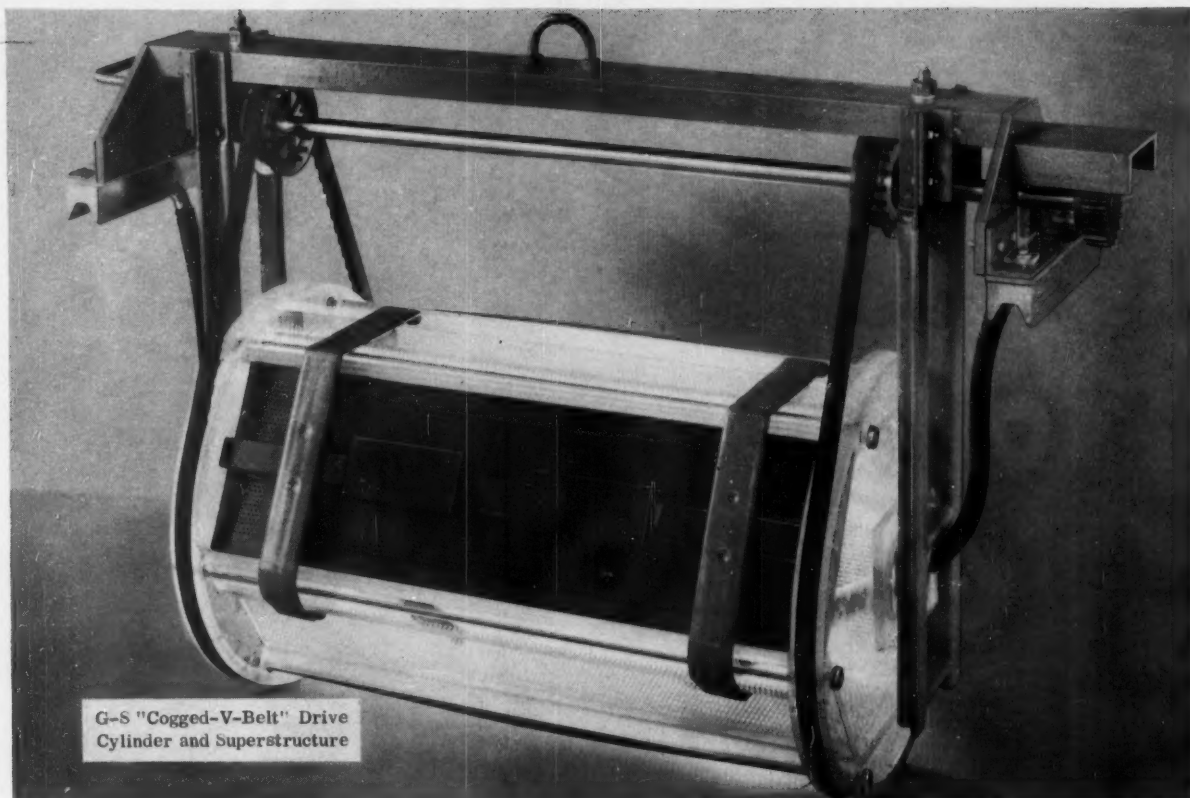
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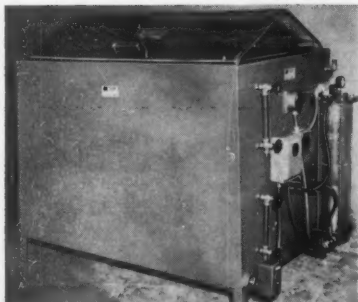
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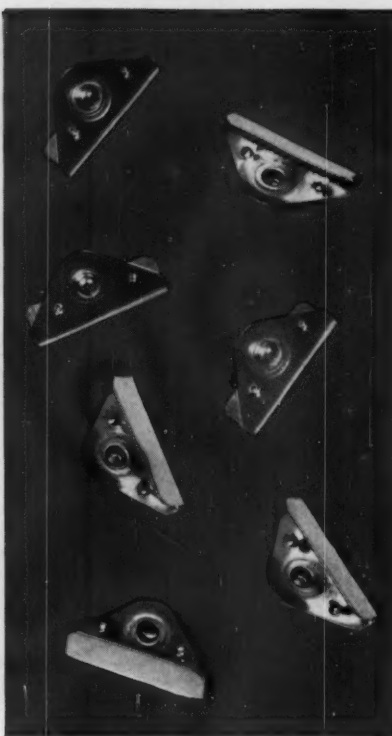
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FEBRUARY, 1960

Volume 58 No. 2

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DIRTY WORK TO BE DONE

Since the first metal polisher grabbed a handful of sand and started to put a finish on his new bronze ax many thousands of years ago, the process has become more efficient but not noticeably cleaner. Manual polishing is a necessary evil, unpopular with industry, and not only because it's dirty. Usually the most expensive part of the finishing cycle by far, it is an unpleasant trade, the practitioners of which seem to be going the way of the village blacksmith, as fewer and fewer workers show any interest in developing the required skills. Anyone who sees a polishing room, even where good housekeeping is a byword, will immediately appreciate the reasons for this decline.

Four alternatives to manual polishing have come into prominence over the years, and are satisfying the requirements of a great many manufacturers. One is chemical and electropolishing, the former in universal favor for aluminum and the latter employed mainly for stainless steel. Formulations and procedures for other metals, such as carbon steel, brass, and zinc-base die castings, still leave something to be desired as concerns commercial application, but development work has been progressing with promising results. Leveling, bright plating baths, a second alternative, have reduced preplating wheel operations radically and have all but eliminated buffing of deposits.

Developments in barrel finishing machines, compounds, and media enable this third alternative method to produce a suitable finish at relatively low cost, and the use of work-holding fixtures has extended the applicability to articles formerly considered too large or too delicate for the process. In the fourth method, the one considered most seriously during the past decade or two, the principle of wheel polishing is retained in order to obtain the characteristic finish, but the man is replaced by the machine.

Automatic polishing machines have pre-empted the mass production industries, designed with an ingenuity in reaching and polishing complex contours that is positively awe-inspiring. Polishing and buffing wheels have been improved to keep pace with machine development, as have buffing compositions, especially in the liquid form. However, research on the principles of wheel polishing has been long neglected and we can point to no really fundamental change during this century, at least. There is an Institute for Polishing Technology in Germany, but, since the war, it seems to have been limiting its work to investigating the effect of lubricants in belt polishing. For an industry of the magnitude of polishing equipment and supplies this disinterest in basic research is a matter of concern. Surely, manual polishing is a fertile field for investigation if there ever was one, a finishing method which is slowly losing ground because no one seems to be trying to improve it.

Nathaniel Hall

Metal Finishing In Europe Today

By Daniel A. Marino, Assistant Technical Editor

This is the second and concluding part of an article describing some metal finishing practices being conducted in Europe (particularly France, Italy and Germany) today. The first part appeared in the December 1959 issue.—Ed.

OUR first impression after having seen some of the larger metal finishing equipment in West Germany was that it is quite similar to that currently in use in the United States. Indeed, much of the research and development work in progress, both by supply houses and by universities, parallels that being worked on in this country. With regard to building semi- and full-automatic platers, a major factor being considered is cost of labor versus cost of machinery. In part, because the cost of labor in Germany is still much lower than that in the United States, relatively fewer full automatics have been produced. The labor market in recent years, however, has become tighter and, with the subsequent rise in labor costs, greater consideration is being given by manufacturers to investing larger sums of money in automatic equipment.

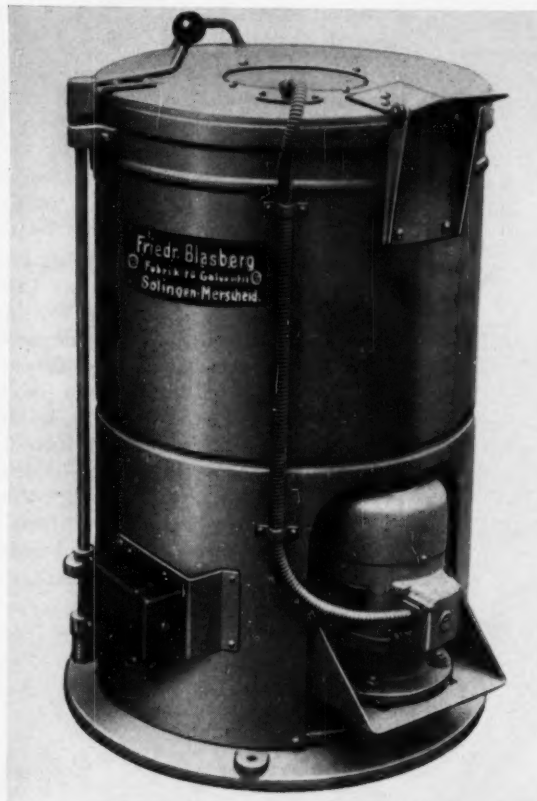
All the metal finishing suppliers visited appeared busy building and testing semi- and full-automatic machines. The executives of these companies expressed similar feelings regarding the current brisk business activity. One was openly and completely confident that the foreseeable future for the electroplating industry in West Germany is bright. In view of this, his company is reinvesting a sizable portion of its assets in order to reap the probable long range profits. Another executive from a different supply house, though also optimistic, was more cautiously so. His company had seen old customers lost to competitors through no fault of its own but rather through the development of the two sovereign Germanies with their partitioned barriers.

One of the most important chemical works, with more than 4,000 employees and which is also very active in the electroplating field, has its headquarters in West Berlin. This company has two laboratories, both for research work and control of customers' baths, in Berlin and Wolfenbüttel (West Germany). Besides these, its customers' needs are also met with seven regional branch offices and about 30 sales representatives in Germany and Europe. A new \$500,000 building in their Wolfenbüttel works is equipped with modern installations for the manufacture of copper cyanide, brighteners, and other electroplating chemicals. The company also has its own plant for the manufacture of electroplating equipment, located in Feucht, Bavaria.

All electroplating supply houses visited have made remarkable progress since the war. In many cases their facilities had been demolished entirely or very nearly so. Some of the large supply houses have very active foreign sales divisions. It was interesting to note that one supplier, who has world wide customers, finds that numerous areas which are in the French sphere of influence are more and more directing their business inquiries to them in the English language, even though their common language is French.

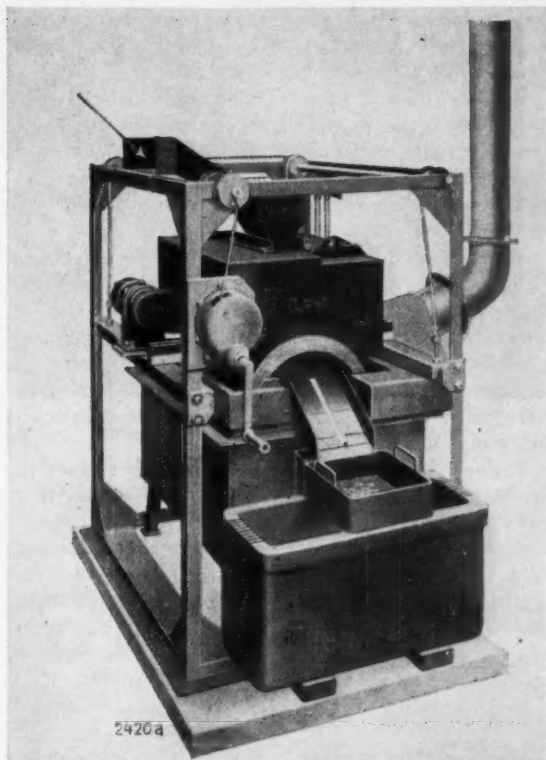
Research and Development

An impressive amount of basic research in the electroplating field is being carried out in Germany. Some work in alloy plating is being conducted under the direction of Professor Raub in Schwäbische Gmünd. In conjunction with the "Swiss Working Community for Electroplating" (Schwiesserischer Arbeits Gemei-



(Courtesy of Friedr. Blasberg)

A Centrifugal Dryer.



(Courtesy of Langbein-Pfanhauser Werke A.-G.)
One of the early models of a chromium plating barrel.

nerschaft für Galvano Technik, SAGT) in Zurich, with whom Dip. Ing. Gruber is associated, numerous joint technical articles are made available in Germany. Another important source for technical information, particularly in the field of gold and rhodium plating, is the "Research Institute for Noble Metals" (Vorschungs Institut für Edelmetalle).

A sizable amount of developmental work on electropolishing had been conducted by one supplier before placing his materials on the market. Some carbon steel and stainless steel items, which were processed by this company and shown to us, displayed a pleasingly bright and smooth surface. One of their proprietary perchloric-acetic acid electropolishing baths was used in an equipment set-up which we were shown. We commented that, because of the possibility of rapid overheating during operation, this type bath is no longer as popular in America as it had been, particularly since the devastating California explosion a few years ago. Our guide assured us that the experimenters were well aware of this heat generated due to the electrical resistivity of the bath and, therefore, have provided the tank with cooling coils. When asked if provision had been made to control rapid and large temperature rises, such as when oxidizing coating materials are submerged in the bath along with the parts as was the case in the California explosion, the guide answered that he did not know.

Electroplating Tanks and Automatics

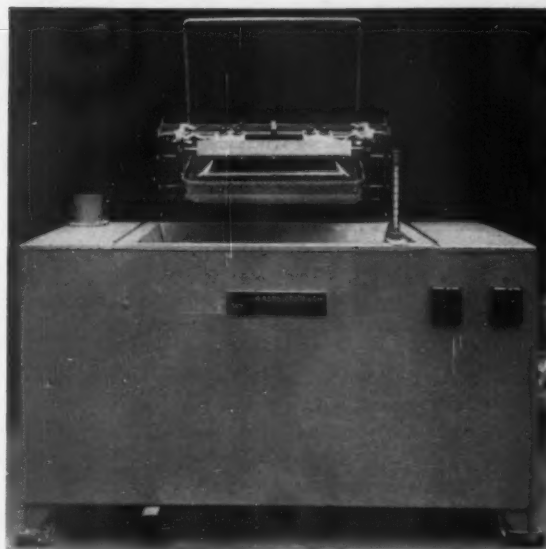
As in America, plating tanks are commonly double electric welded. Some suppliers, however, only double weld rinse tanks when they are to be lined. The

reasoning behind this is that the chances of having air pockets beneath the lining are minimized when the linings are applied directly to the weld bead.

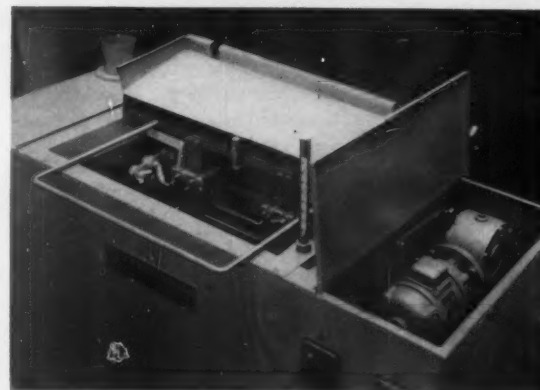
Carousel or round type plating automatics are still popular in Germany where they apparently originated. When the diameter of the outer wall of the tank is to be larger than about 16 feet, straight lined type (one way or return) are preferred.

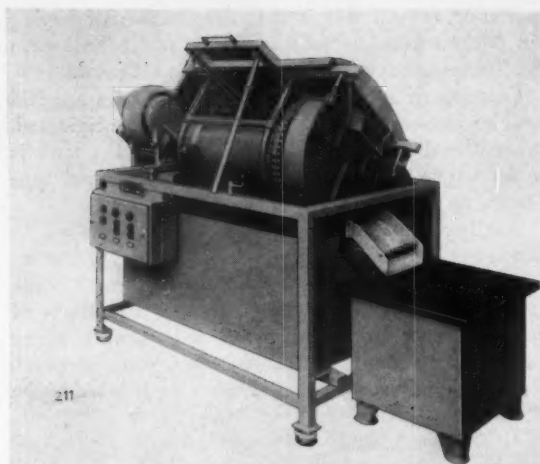
Another unit of plating equipment developed in Germany is the chromium barrel plater. The story told by the company which made the first unit (1938) indicated that it was largely through the efforts of an employee who formerly was a locksmith. Many improvements have been made since that time and, today, a significantly large number of items may be chromium plated in rotating barrels.

At another plating equipment company, we were shown equipment which chromium plates items by a different method. The unit consisted of a rocking metal basket which permitted parts to be exposed on all sides during plating. A special oscillating motion allowed the parts to separate momentarily, while sufficient contact of the parts to the electric power source was maintained to produce satisfactory chromium deposits.



(Courtesy of Dr. W. Kampschulte & Cie.)
Above, basket chromium plating unit with basket in raised position; below, with basket in tank.





(Courtesy of Langbein-Pfahner Werke A.-G.)
A modern chromium plating barrel.

Hard rubber and rigid polyvinyl chloride (PVC) were the most common types of coating materials seen on plating tanks in Germany. As Italian suppliers lauded the merits of PVC for these purposes, so too did their northern neighbors. It was interesting to learn that plating equipment producers in both Italy and Germany independently tried various manufacturers' materials, then settled on the same manufacturer's PVC, attributing to this material the optimum qualities for plating room purposes.

Laboratory Testing

Two laboratory equipment suppliers had on the market electrical testing instruments which could rapidly and accurately determine catalyst content of chromium plating baths. We were impressed by the results of the tests shown, since we remember only too well the relatively involved efforts required to check sulfate content gravimetrically. We had not witnessed the steps required to prepare the samples for the instrument but, after being told what they were, the electrical method of testing was no longer as inviting a procedure as it had seemed. When very large numbers of samples must be checked at a time, the instrument can be utilized effectively. One supplier indicated that the instruments have not been in great demand and that he is still selling centrifuges in similarly large numbers as he had been prior to his introduction of the electrical testing method.

Rectifiers

In the field of electrical power equipment, except for very specialized (and usually very large) applications, the rectifier has all but replaced motor generators. Every rectifier observed, both in manufacture and in use, incorporated selenium diodes. On all newer units, special processed selenium is preferred. This type diode, along with being less prone to overheating, has an exceptionally long life with relatively low ripple.

Air and liquid cooling were about equally popular in the units observed. One large supplier of rectifiers stated that 95% of his units are of the oil cooled type. This may help explain why less emphasis is placed

on keeping rectifiers away from plating room fumes and poor ventilation as much as practical, as we in America often recommend.

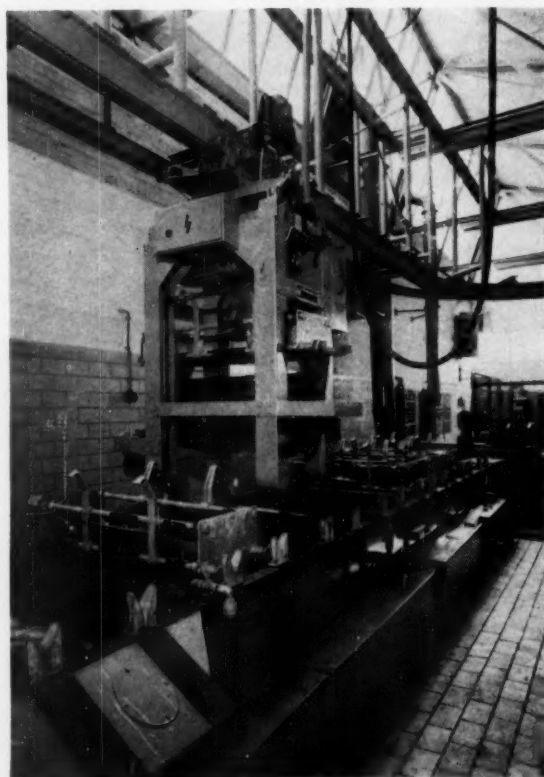
Another manufacturer of oil-cooled rectifiers apparently has an extensive background in the field. Over the years the company has continually evaluated coolant oils for their units, so that today it can with confidence incorporate suitable coolants for each type rectifier it manufactures.

In many rectifiers observed in their manufacturing stages automatic current density controls were common. However, only mechanical systems were being used. This was somewhat surprising since the first non-laboratory usages of saturable core reactors (though in this case for communication purposes) were found on captured German airplanes and pocket battleships during World War II.

A guide informed us that, as with other types of diodes, his company is cautiously investigating new controls for electrical power sources. He further stated that only after they have reasonable assurance that their new innovations are ready for commercial exploitation will they put them on the market. Perhaps, this is a lesson learned from unfortunate American experiences when new laboratory developments were incorporated into commercial products too early.

Anodizing

Aluminum anodizing is a popular surface finishing treatment in Germany. Numerous proprietary baths are being marketed, an important one of which is an oxalic acid type. One supplier who markets chemicals



(Courtesy of Dr. W. Kampachulte & Cie.)
Cadmium barrel plating automatic.



(Courtesy of Dr. W. Kampachulte & Cie.)
Control panels for an automatic copper plater.



(Courtesy of Schering AG.)
A typical electroplating research laboratory.

for the process recommends aluminum cathodes in hard rubber lined tanks.

Strictly visual results of the process which we encountered, both after anodizing and subsequent dyeing and sealing, indicated that there is little difference between German practice and that in the United States.

Electroplating Automotive Parts

As the per capita wealth of Germany increases, so too does demand for all industrial products, from Volkswagens to inexpensive steins. On the more expensive end, however, a new market is being created. Some who have owned Volkswagens and even Mercedes-Benzes for years are beginning to change their esthetic values to some extent. These strictly German designs, though straight-forward and practical, lack the glamour, elegance, and comfort of many American-designed autos to these people. Even though the prices are usually higher, American-type autos, such as European Ford, are beginning to sell very well. Both for this reason and because we had heard that a great deal of expansion of building and machine facilities was underway at the plant, we selected a tour to the huge Ford Works in Cologne.

This plant employs about 14,000. For the most part, the active facilities have been constructed since the war and have the characteristic modern, pragmatic appearance of many of the newer plants in the United States today. Functionally, it differs from our own

automobile manufacturers' plants by having a larger percentage of its operations of the manual type. Though there are spaces in numerous areas which are not already automated to incorporate such operations, it also appears that some serious material flow problems would result in other areas should the operation be made automatic.

In view of the previous labor market conditions, it was less expensive to hire many workers who could be paid relatively low wages to do particular operations than to invest capital in expensive automatic machinery. As the labor supply dwindles, causing wages to increase and, as production output and quality requirements increase, much thought is being given to automating operations. One such process witnessed was a full plating automatic which had recently been installed and put in production operation. The unit was being used to apply a bright leveling copper and a bright nickel plate. The operations had been accomplished previously with a hand polishing procedure and re-racking prior to bright nickel plating.

Another operation which also involved a full automatic plater was being tested. This machine was designed to copper strike, bright nickel plate, then chromium plate other types of automotive trim. Plating rack designs were being changed to provide good positive contacts through the entire plating cycle.

At the time of our visit the "working-in" operations for the second new full-automatic were in progress. For the large size of machine and intricate problems involved in the installation, it was surprising to see how well the equipment was behaving in these initial trials. The supplier appeared to have full jurisdiction to handle every last detail of its installation and operation (which case we had not seen previously in the United States) with the Ford company simply waiting until the unit was considered ready for production.

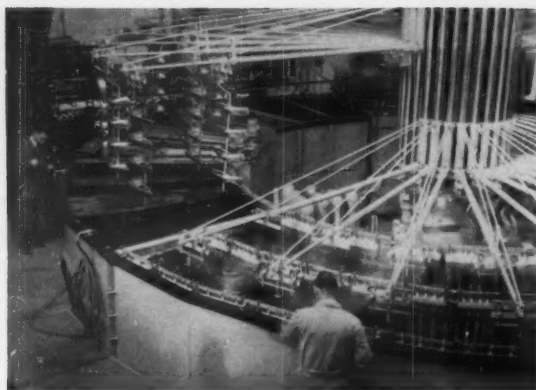
A third and older automatic was also in the electroplating area. Its purpose was to put a heavy copper on the parts. The parts first went into a cyanide copper bath which had a volume of 5,300 gallons and then into an acid copper bath which had a volume of 27,800 gallons. The parts were then buffed and nickel plus chromium plated. We were told that the company was in process of raising their electroplating standards.

Porcelain Enameling Stoves and Refrigerators

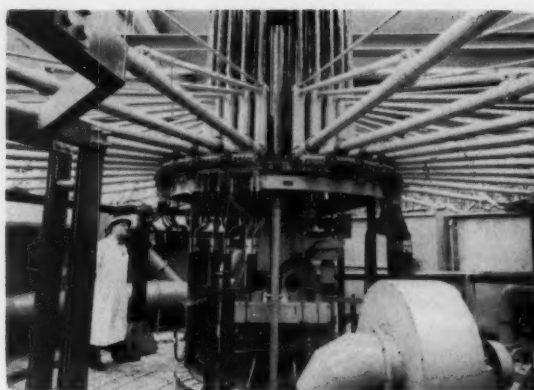
On another occasion we visited a factory in a small



(Courtesy of Schering AG.)
Mixing room for formulating electroplating bath chemicals.



A



B

(Courtesy of Dr. W. Kampachulte & Cie.)

a) A carousel type automatic which nickel and chromium plates automobile parts; b) Mechanical structure of the carousel nickel and chromium automatic.

town in South Germany (near Stuttgart) where surface coating and assembly operations were being conducted in the production of stoves and refrigerators. We were told that the parent company is among the largest producers of stoves in Europe.

The plant received all parts required for final products unassembled and uncoated. Another one of its factories nearby did the electroplating of nameplates and trim items, which was the only finishing not done in the building.

The plant, which had been in operation for three years, had a modern, clean, and efficient production layout. All the equipment was new, and numerous interesting innovations were incorporated into much of it. Almost all parts were carried through the main shop area by means of overhead chain conveyors.

Quality control was conducted both on the raw materials and on the coated parts in a well-equipped laboratory. The enameling iron was checked for chemical composition, tensile strength, and impact strength, among other properties. The coated parts were checked for color variation, detergent chemical resistance, bond strength, salt spray, and cyclic immersion. At one time numerous color variations were prevalent but, with an improved system of electrical interlocking control incorporated into the firing furnaces, the

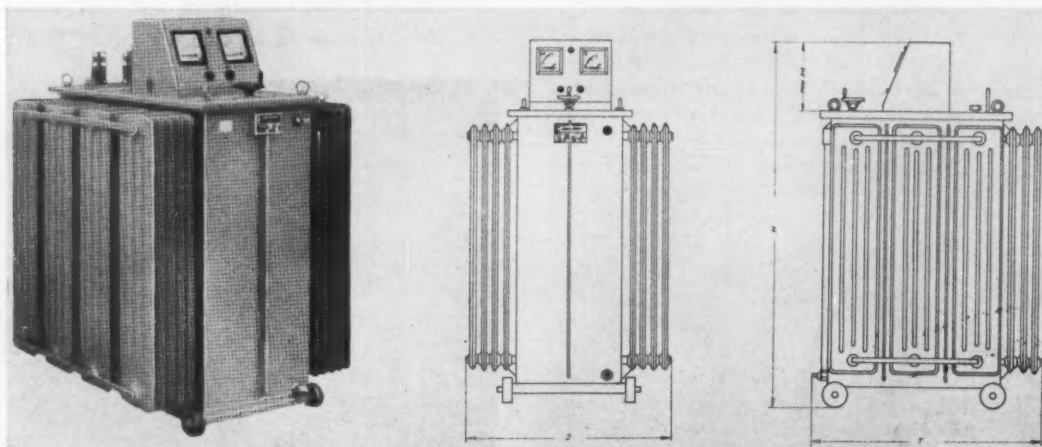
porcelain enamel finish became highly improved. We were shown that, from batch to batch, very little color variation occurred.

Surface preparation prior to porcelain enameling or painting was conducted in a large automatic. The unit was about 40 feet long and 8 feet wide, and included an interesting hydraulic lift system. The parts were stocked in jigs which were then placed in large rectangular baskets. The baskets were lifted, then transferred, then lowered into each subsequent tank in the line by means of two long, horizontal steel channels. A ball and socket arrangement on the channel and on the lip of the baskets, respectively, assured proper placement and transfer of the load.

Special enameling iron was used for all parts which were to be porcelain enameled; these included the vast majority of the parts. The steps in the surface preparation cycle included:

1. Alkaline immersion cleaning
2. Warm water rinsing
3. Sulfuric acid dipping
4. Warm water rinsing
5. Nickel sulfate dipping
6. Warm water rinsing
7. Hot air blow-off drying

(Continued on page 62)



(Courtesy of Langbein-Pfanhauser Werke A.-G.)

A portable, self-contained oil-cooling rectifier showing radiating plates.

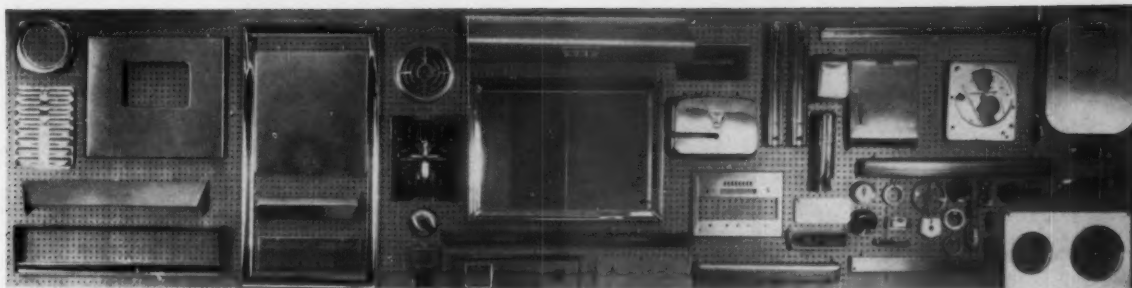


Fig. 1. A few items fabricated of pre-finished metals.

Fabricating Qualities of Pre-finished Metals

By F. P. Romanoff, Technical Director, Apollo Metal Works, Chicago, Ill.

IN the course of producing plated metals for subsequent fabrication, various methods have been investigated to determine quantitatively the effect of electrodeposits on the base. These pre-finished metals, in sheets or continuous strip, are used to fabricate many items, such as shown in Fig. 1. Besides the possible opening up of the plating to expose the basis metal, the latter may be embrittled by the deposit. Substantial losses could occur due to fracture of the composite metal during stamping, drawing, or other fabrication. In earlier tests utilizing the Ericksen or Olsen instruments and modifications of these, the slow extrusion did not represent actual fabrication performance.

A tight bend test of 180° , or a ball penetration test on a plated copper base would not disclose red copper through 0.00025" of ductile nickel. Non-ductile deposits of this thickness fracture, exposing the red copper base. Deposits of ductile nickel up to 0.006" thick were found to have no effect on the fracture depth of the unplated base when a cup was drawn in a modified Ericksen cup test. These are qualitative, but useful tests.¹

Various tests have been used on films to determine physical properties, including elongation, of deposits which were stripped from the basis metal. Folding a foil about 0.001" thick did not indicate the ductility or elongation of the deposit. This was evident when a bright nickel deposit on copper disclosed the red base through cracks formed in an extruded cup. This hard deposit, one mil thick, when stripped as a foil could be folded and creased without fracture, although tensile tests on a 0.025" deposit showed practically zero elongation.

The Olsen Stiffness Testing Machine used on foils about 0.01" thick, determines a set angle which is related to the ductility. This is indirect but is rapid and satisfactory as a laboratory test.² The usual tensile testing machines also require a substantial nickel

deposit of over 0.01" to satisfactorily determine the ductility of electrodeposits. This has been used for investigation by others.^{3,4}

Data on tests of electroplated sheet or strip on the usual tensile testing machine have not been available. A test which would simulate a punch press operation on prefinished metal was desired, as the speed of deformation often has an effect on the fabrication limitations. The dynamic ductility machine described in the American Society for Testing Materials Standard for Rolled Zinc, Designation B-69-39, was found to be adaptable for routine testing. This machine (Fig. 2) is essentially a modified inclinable punch press fitted

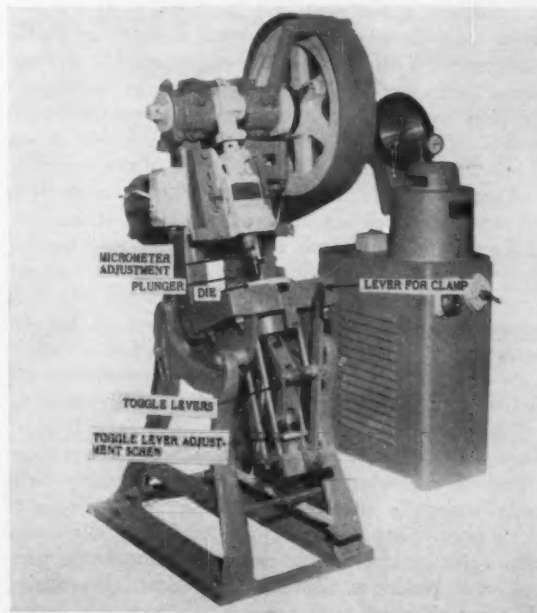


Fig. 2. Dynamic Ductility Test Machine.

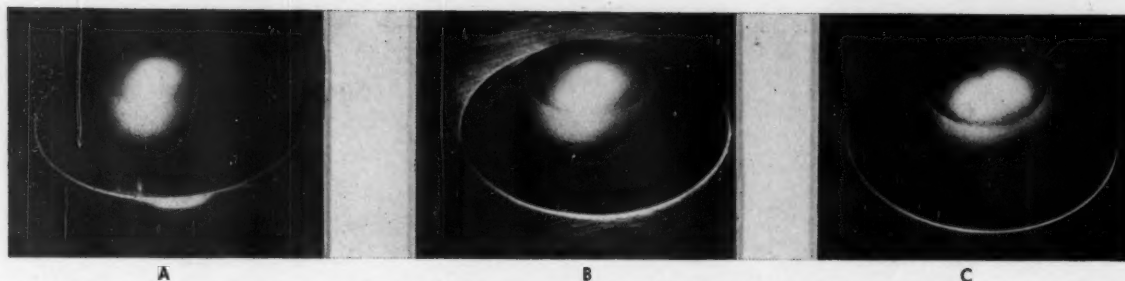


Fig. 3. Typical cups formed in ductility test: (a) before rupture — 325 mils (8.257 mm.) — this is the necking value used in tables and charts; (b) at rupture — 330 mils (8.380 mm.); and (c) past rupture — 335 mils (8.507 mm.).

with a micrometer-adjustable $\frac{7}{8}$ inch diameter ball die, and a toggle operated clamping device. The test specimen is 3.5" wide, by 18" or more long. A series of cups is made along the middle line of the strip as shown in Fig. 3. If the first cup does not show fracture, the plunger is advanced in increments of 0.005 inch (0.127 mm.) until rupture occurs. It was found that some steels have considerable flow or "necking" which persists over an increase in depth of 20 to 30 mils beyond the first necking. Some steels would show no "necking" and an increase of cup depth of 5 mils would produce rupture. The end point found most satisfactory on the prefinished and basis steel is the cup depth just before the first detectable fracture of the base takes place.

Most steels utilized for prefinished products are of a premium grade, low carbon, #4 temper, rimmed steel, with Rockwell values of 50 to 60 on the 30T scale. A number three mill finish is usually specified. This is rolled for a high grade plating surface. Although most of the steel is uniform, unplated strip steel of any gauge from the same mill as well as from other mills, may give varying depths of draw, sometimes in the same coil. Therefore, tests are made on adjacent or relatively close pieces of unplated and plated panels.

Fracture in the steel and in the deposit depends upon many factors besides normal dislocations in the basis metal. Visible or microscopic external or internal flaws, pores, cracks, fissures, scratches in the deposit or basis metal, etc., may serve as notch nuclei. Propagation of the notch present, or formed during extrusion of the cup, results in fracture of the dome.

Reproducibility is usually as good as other tests of physical properties of sheet and strip steels. Non-uniformity in some steels and electrodeposits is readily noted. The best reproducibility is obtained on degreased or washed specimens. The presence of oil or grease will affect the depth of draw of all but extremely brittle deposits, as in the case of some bright deposits. After initiating the degreasing requirement, buffed copper or nickel deposits did not always show an increase in the depth of draw, especially if aged. Deposits of copper, brass, nickel, and chromium, when tested shortly after removal from the plating bath, usually show a substantial decrease in the depth of draw as compared to the basis metal. This is eliminated with aging or buffing. The decrease is not always present on all plating at all times, and the variable causing this condition has not yet been determined. It was found in early tests that ductile electrodeposits of nickel

or copper, up to 0.0025", did not reduce the depth of draw obtained on the unplated steel base. This was the maximum thickness tested on the machine thus far. Deposits from the usual production baths, and those containing most brighteners, show failure at lower cup depths as the thickness increases. This inverse relation of cup depth to thickness is also found with electroless nickel deposits on low carbon steel.

The rating applied to deposits can be expressed as a ratio of the depth of draw of the plated steel to that of the uncoated basis metal. However, this does not provide the gradation required because of the variations of cup depth in the steel base even in the same gauge. The change in ductility is easily noted by an increase or decrease in the depth of the cup after plating.

As in most tests on steel strip, all sorts of variations are possible. Some steels show a greater depth of cup when tested on one side than on the other. The physical properties of steel strip depend upon many factors. Besides the usual ladle analysis and rolling practice, any particular area may differ in performance due to segregations, dislocations, surface imperfections, scratches, corrosion residues, irregular pickling or annealing procedures, etc.

Variation in the cup depth at fracture on most strip steels seldom exceeds 5 mils. When a greater variation is found, tests pieces of both the plated and bare base will often show a high or low depth of penetration at the same cup location along the direction of rolling. (Fig. 7.)

However, as a series of cups is made on several pieces within a few minutes, any variable pattern usually can be readily interpreted. There is an occasional unexplainable gross variation in the depth of draw of one cup in the basis or plated metal which is not reproducible. This could be the site of an extreme dislocation or deep pit, which may not be determinable after the cup is punched. All tests of the basis and plated metals are made at the same time for any series of tests. If an extensive investigation is undertaken, sufficient unplated basis metal interspersed between specimens to be plated is saved, to avoid discrepancies due to possible variation of the steel with aging.

Procedure

For routine checking of sheet production, a test piece about 8 feet long is cut from the coil. The face is marked and the sheet is degreased. Two or more 3.5" pieces are cut from each end. The balance of the

sheet is usually plated to a thickness of 0.0003" or more. Test pieces are cut from the remainder after buffing and degreasing. Cup tests are usually made on the back and face of the raw and plated test pieces.

Results of these tests indicated that the ductility is a function of the solution. Impurities tend to reduce the depth of cup in this test. In order to operate a practical production bath, it is necessary to use ductilizing agents to sequester those contaminants which are continuously finding their way into the processing solutions. Besides organic contaminants, atmospheric dust carries a variety of products into the bath, depending upon the industrial area. Any dele-

terious material entering the cathode film may affect local areas before sufficient dilution renders it harmless. Periodic permanganate purification of nickel solutions and the use of other specific purifying agents have permitted the operation of plating baths which continuously produce uniform, ductile deposits of copper, brass, nickel, and chromium.

Results for production runs and test panels prepared by various proprietary process or solution vendors are shown for copper, brass, and nickel, in the following tables and charts. Table 1 illustrates production tests of interest on nickel and brass deposits.

TABLE 1
Routine Production Dynamic Ductility Tests.
Deposit Buffed, Except As Noted

	Thickness inch	STEEL BASE		ELECTRO PLATED		Deposit thickness × 10 ⁻⁶ inch		Rockwell Steel Base	
		Depth of draw at necking mills		Depth of cup at necking mills				T30	
		Back	Face	Back	Face	Face	Back		
1	0.031	310-15 (E)	320-30	320-325	305 (A)	NICKEL TESTS	330	190	54
2	0.031	310-315	330-35	325-35	340		280	190	48
3	0.031	330-35	320-330	350-55	345-350		360	320	48
4	0.025	320-25	320-330	335	325-330		320	190	
5	0.018	245-50	235	{ 220 255-60	{ 210 (B) 245		255	50	
6	0.031	340	335-40	345-50	335-40				58
7	0.018	220-25	225-30	220-25	220-30		190	140	68
8	0.031	330	330	315-25	320 (D)		120	110	
9	0.025	315-330	330	325-330	335-340		370	390	
10	0.025	330	330-35	330-35	335		1080	810	
11	0.031	325-35	330-35	335	335-40		1460	21	.
12	0.031	330	325	320-30	330-35		BRASS TESTS	240	70
13	0.031	330	320-35	330-35	315-20 (A)	300		120	
14	0.031	330-35	335	300-05	310-15 (C)	220		40	
15	0.031	335	335-40	330-40	335-40	170		30	
16	0.031	330	330-35	350	340	330		70	50.5
17	0.018	300-05	300-05	280	275-80 (D)	220		250	

NOTES ON TABLE 1

A. Low cup values are occasionally found when the face or best side of the steel is penetrated. The poorest surface, or back of the steel, is then placed in greater tension. As this surface has most of the mill defects such as open surface, scratches, pits, etc. the deposit may accentuate these defects and produce notch nuclei more readily. Buffing the nickel deposits on this side usually does not overcome these low values when they do appear. Occasionally, some strip steel will show a reversal of this tendency, which is probably due to the bright surface having more of the critical defects. (See note E below.)

B. The low results represent the cup on test panels prior to buffing. The high values were obtained on adjacent panels after buffing. Aged, unbuffed, ductile material usually results in values approaching those of the buffed product. (See Fig. 4.)

C. This brass plated material spotted out very badly, indicating the steel to have a very porous or open surface. However, the ductility was not affected, as test No. 15 on the same steel (the next day) resulted in good ductility after treatment of the bath with purifying compounds. Nickel deposits on this same steel also had good ductility.

D. These represent nickel and brass baths providing good

appearance and buffability but poor ductility, due to contamination.

E. The depth of the cup drawn with the face of the basis steel under greater tension, (the back is punched) was lower than that of the cup drawn from the other side. This variation in the steel does occur with sufficient frequency to warrant that all tests be made on both sides of the metal where practical. The test (back) on the plated specimens indicates the nickel to be ductile, as the cup is 15 mils deeper than that obtained on the unplated steel. The cup drawn with the back under maximum tension of this same plated material (face) fractured at a low value. This seems to indicate the back surface of this particular area of the steel contains nuclei of notching type, as described in note A. Panels from several adjacent lengths of this steel fractured at low values in the same way. Test No. 2, taken on a sheet from the same steel coil but nearly 100 feet away, indicated that the critical defective area, which tended to fracture at low values after plating, had been eliminated. Test No. 3 on the same steel, but taken deeper in the coil, indicated that the area of steel which had the lower value when the raw steel back was punched, had been passed. A repeat test on panels cut from the earlier pieces, reproduced the low values for the back of the unplated steel as obtained in tests numbers 1 and 2.

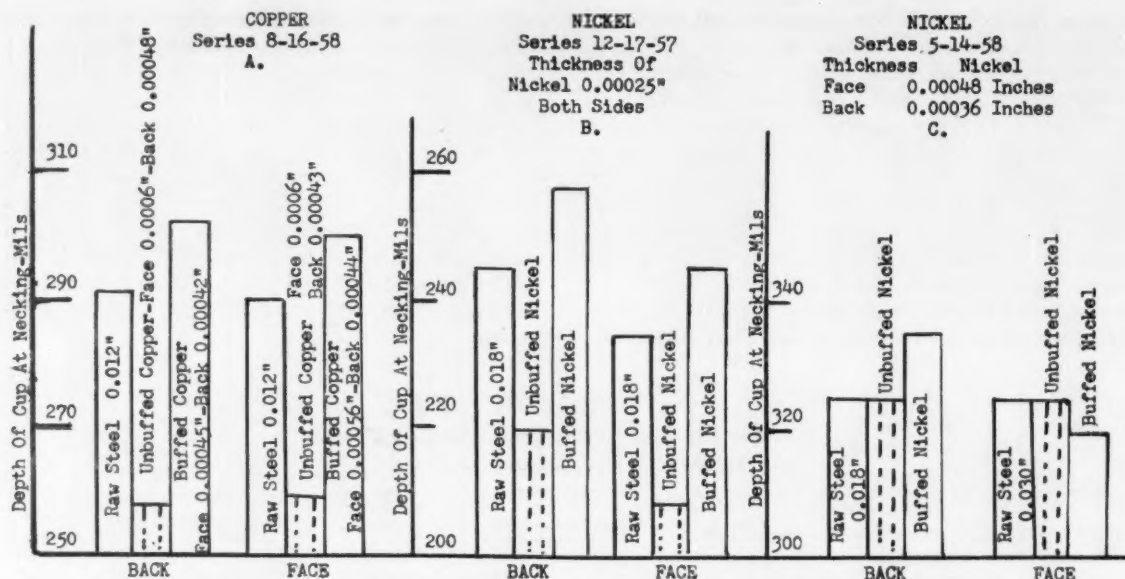


Fig. 4. Effect of buffing. Sets A and B tested same day as plated, set C tested several days after plating.

Discussion

Production runs of Table 1 illustrate the variable results which are due to basis metal variation. The gauge of the steel does not always provide an indication of the permissible depth of draw. When deep stampings are made in sheet metal, some breakage is nearly always experienced. The losses vary from over 10 per cent to a negligible quantity, depending upon the severity of the draw. The depth of cup obtainable with any gauge cannot always be predicted from a

hardness test. Rockwell values of specimens 2 and 3 are equal but the depth of draw of the base at fracture varies. Panel No. 6 of the same gauge has a deeper draw, although the Rockwell value is 10 points higher. Specimen No. 7 was a No. 2 temper steel, utilized primarily for ferrotype plates. It is somewhat harder than that usually used for forming. The deposit was not as thick as is usually applied for these tests but is ductile. However, a deposit thickness of this order or even less of non-ductile nickel affects the depth of draw appreciably, as noted in test No. 8. Tests 9,

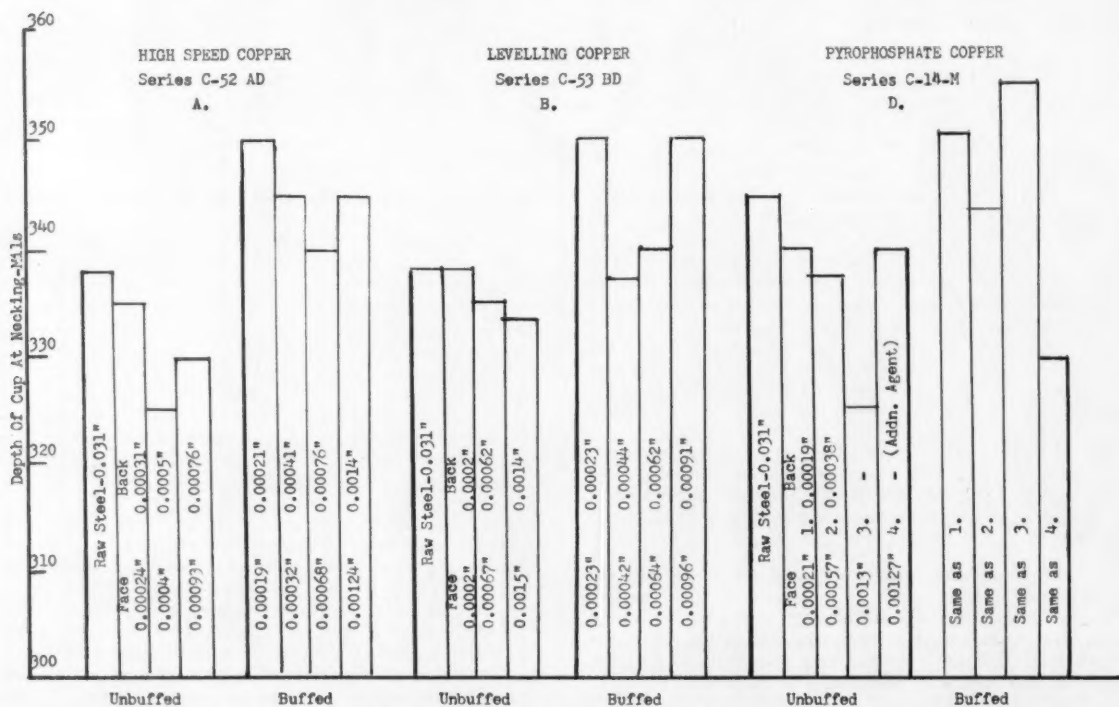


Fig. 5. Effect of buffing on proprietary copper deposits.

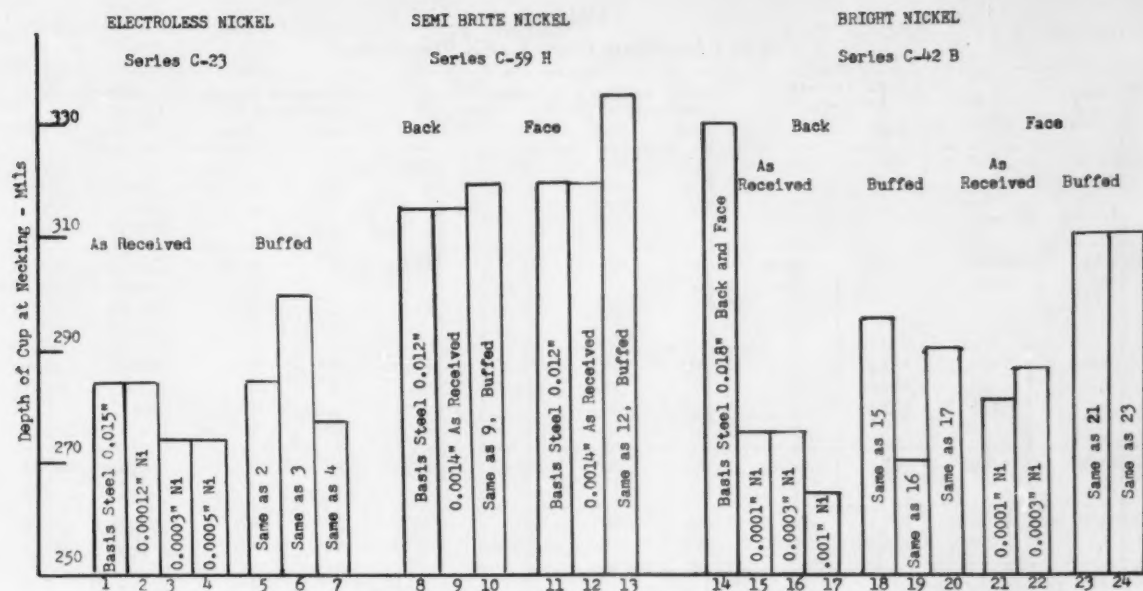


Fig. 5A. Proprietary Nickel — Thickness by Vendors.

10, and 11 show that the thickness of the deposit has a negligible, if any, effect on the test when the nickel is ductile.

These tests also indicate that the deposit thickness distribution on both sides does not affect the depth of the cup if the deposit is ductile. The results on brass deposits correspond to those obtained with nickel. The effect of buffing ductile deposits, in general, is to increase the depth of cup over that of the unbuffed deposit. Fig. 4 illustrates this. However, unbuffed material is often almost as ductile as the buffed material (group C), especially after aging. The degree and aging effect is fairly consistent for ductile deposits.

In Fig. 4 the bar graphs of copper and nickel illustrate routine tests after plating. The substantial drop in ductility of the composite shortly after plating, and the recovery after buffing, is shown in groups A and B. Group C shows the results of tests made several days after plating. The unbuffed nickel, after aging, has recovered its ductility, which is now equal to that of the unplated steel.

A similar result was noted with proprietary copper and nickel deposits. Fig. 5 shows the effect of the thickness of deposit and ductility on buffed and unbuffed proprietary copper deposits. The time elapsing between the plating and testing was a week or more. As this material has aged, the loss in ductility prior to buffing is not as great as that illustrated in Fig. 4, groups A and B. The general trend is for unbuffed deposits to show a decrease in ductility as the deposit thickness is increased.

Variations from the trend are not significant, as the actual time of aging was not known. Buffing the copper resulted in increased ductility, the increase also being independent of the thickness on these ductile proprietary copper deposits. The pyrophosphate copper values in group D, Fig. 5, indicated that the copper deposited from this bath were as ductile as those produced in the cyanide baths. The last set of pyrophosphate

copper plated panels in group D, No. 4, in Fig. 5, with the lower results after buffing, were identified as having been produced in a bath to which a brightening agent had been added.

Fig. 5 A presents several proprietary nickel deposits. The electroless nickel data could indicate a fairly ductile deposit when buffed. However, the entire surface of the dome was badly cracked on all specimens. Apparently, the severe cracking of this structureless nickel does not penetrate the base appreciably to cause notch propagation.

The semi-bright proprietary nickel was found to have good ductility, while a bright nickel was definitely on the brittle side. Buffing had a variable effect on this bright nickel deposit. Other bright nickel tests confirmed this. Buffing most bright nickel deposits, however, did not improve the ductility.

Chromium On Nickel

The effect of chromium on the ductility of nickel has been investigated on ductile nickel deposits. The first runs, with the usual chromium bath, resulted in some loss in ductility. Series No. 1, dated 1-24-58 in Table 2, illustrates this. The nickel was ductile, but chromium plated panels showed a considerable reduction, 25 to 35 mils below the cup depth obtained on the nickel plated steel.

Changing the chromic acid-sulfate ratio and the introduction of a wetting agent overcame the embrittling effect of the chromium. Deposits of chromium, 40 to 50 millionths inch thick, have little effect on the cup depth when plated over 0.0002 to 0.001" of ductile nickel.

These could be heard to crack when flexed. However, the cup test indicated no embrittlement of the composite. The appearance of the extruded domes was similar to those of the basis steel or ductile nickel. If the chromium deposit does fracture during punching, the fine notches developed do not propagate into the

TABLE 2
Effect of Chromium Over Nickel Plated Steel

Date and series	Gauge inch	UNPLATED STEEL Depth of cup mils		NICKEL PLATED Thickness $\times 10^{-3}$		Depth of cup mils		CHROMIUM PLATED Thickness $\times 10^{-3}$		Depth of cup mils	
		Back	Face	Face	Back	Back	Face	Face	Back	Back	Face +
1/24/58 1.	0.031	350	345	280	255	350	345	5	—	—	315
		"	"	270	260	—	—	4	—	320-25	310
		"	"	270	230	—	—	5	4	315	310
				—	—	—	—	5.9	3.9	320-25	315-20
9/6/58 2.	0.031	335-40	335-40	230	120	345	340-45	6	—(A)	340-50	340-50
	0.031	335-40	340	—	—	—	—	5	4(A)	340-45	345
				—	—	340-45	335-40	5	4(B)	330-35	340
								6	4(B)	340-45	345
9/24/58 3.	0.036	340-45	340-45	330	240	335-40	330-40	10	12	330-40	330
	0.025	315-25	320-25	860	770	320	310	8	—	320-25	310-15
	0.025	300-15	—	660	390			9	—	315	
								10	11	—	315-20
2/20/59 4.	0.036	340	335-40	335	290	335-40	340-45	16	11	340-45	340-45
2/24/59 5.	0.020	285	270-75	360	360	290	270-75	24	25	285-90	270-75
	0.020	285-310	275-80	335	350	290-95	280-90	52	57	310-15	285

(A) One side (face buffed).
(B) Two sides buffed.

nickel surface to reduce the ultimate cup depth. This behavior is similar to that of electroless nickel. However, these deposits do not develop the alligator skin network or crazing usually associated with this thickness of chromium. Chromium plating usually reduces the depth of cup when applied to non-ductile and bright nickel deposits.

Chromium On Steel

A few runs were made of chromium deposits directly on a steel base. A summary of two runs giving the average values of the penetration depth of cups at necking is shown in Figs. 6 and 7. These were plated so one end of the steel sheet was plated on both sides, while the back of the other end was shielded by a piece of the same material. The results of plating chromium directly on low carbon steel indicate that hydrogen is not the embrittling factor. The bar graphs of Figs. 6 and 7 are averages of four or more panels, with 25 or more punched cups. There is a trend for increasingly thick deposits to reduce the embrittlement of the basis metal.

Plating both sides of the steel also generally reduced the embrittlement although twice as much hydrogen is evolved. The application of the chromium on one side probably produces a stressed effect on the steel. Plating both sides would tend to balance this stress. In group A, of Fig. 6, the cups represented by No. 4 panels had the same thickness of chromium on both sides. The depth of cups or ductility is greater than that of panels represented by bar No. 5 which has more chromium but not the same amount on both sides. The second set of bars in Fig. 6B represented the same lot of panels as in set A, but punched on the face side. These provided some evidence that the stress of the deposit reduces the ductility. When the cups were punched so the chromium-free back was placed in greater tension, the depth of draw prior to fracture was significantly deeper than that obtained when the

chromium plated surface was in greater tension. Cups of No. 7 and 8 panels are to be compared with those of Nos. 2 and 3. Cups represented by No. 8 panels, where the unplated steel is in maximum tension, were slightly deeper at fracture than the basis steel.

The cups punched on two sides plated material were usually of the same order of magnitude when either face or back were punched. The groups C and D panels in Fig. 6, with thicker deposits of chromium, were punched from another gauge of steel of another heat. However, the same trend is noted. The loss of ductility when chromium plated on one or both sides of these panels, was less for the thicker chromium deposits than that of the thinner deposits in groups A and B. This may indicate a tendency for the deposit to crack with less propagation of these cracks into the base. It will be noted in Fig. 6 that panels Nos. 4 and 13 have deeper cups in their respective series. Both have almost the same thickness of plate on both sides. Cups drawn on both back and face of thicker chromium deposits, sets of panels 13 and 16, are also deeper than those obtained on panels 4 and 9 with the thinner deposit.

Correlation

Tests made as a check about 10 months later are shown in Fig. 7. Here, again, the trend is for chromium plated material on both sides to have greater ductility than that plated on one side, and deposits show less loss of ductility with increased thickness. Although the basis metal used in the two groups of tests in Fig. 7 was cut from the same steel coil, there was considerable difference in the cup depth between the basis sheet plated with about 4 millionths inch (panels 1 through 8), and that plated with 10 to 15 millionths inch of chromium (panels 9 through 16). As the tests were made some weeks after plating, it could not be established whether the cut sheets were adjacent or fairly far apart in the coil.

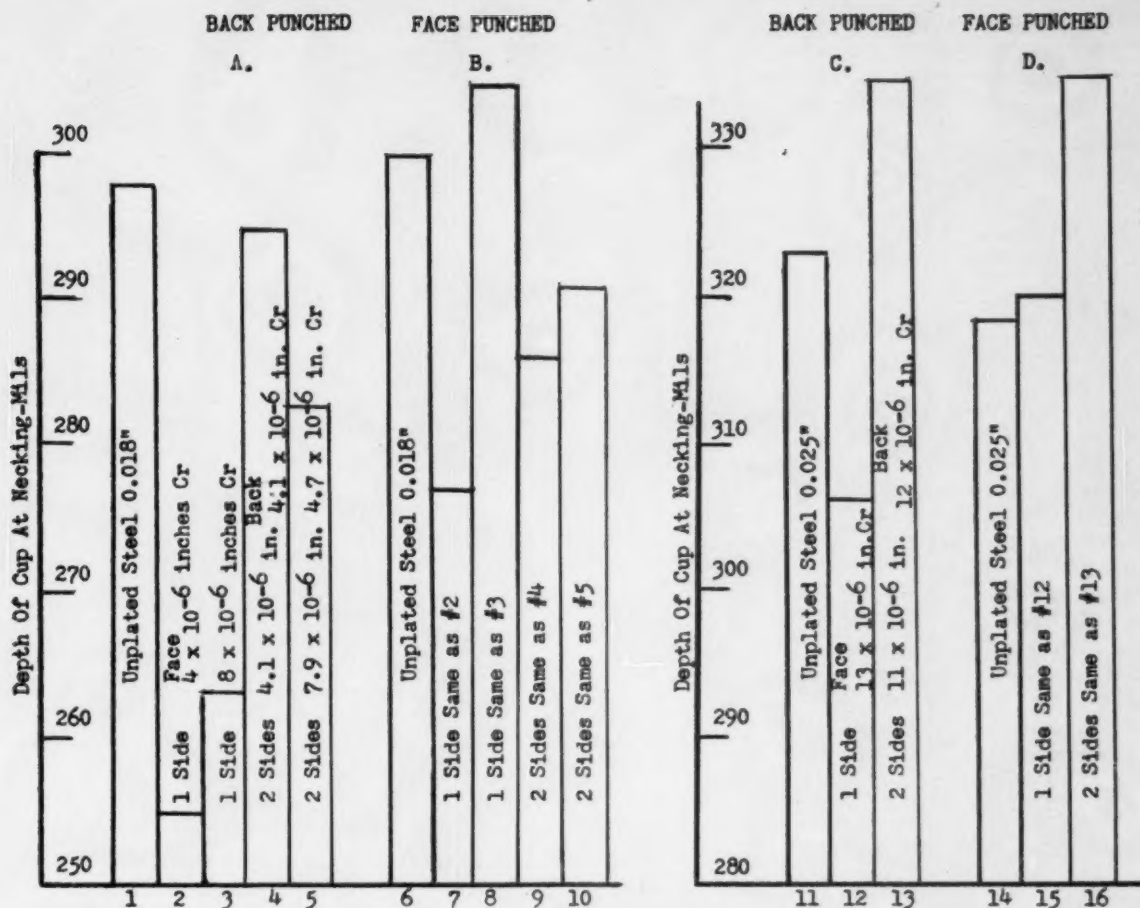


Fig. 6. Effect of Chromium Plate on Steel.

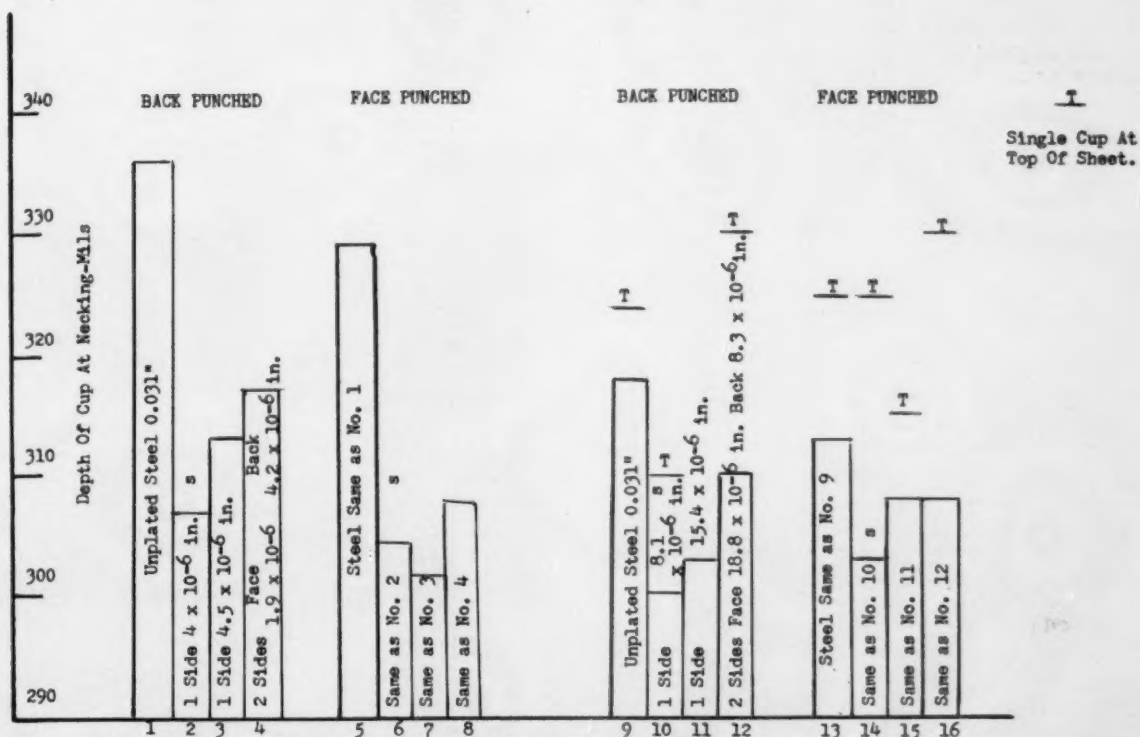


Fig. 7. Effect of Chromium Plate on Ductility of Steel.

The bars marked "s" represent the cup tests on the short pieces of steel used to shield one end of the sheet while plating. The series of tests in all panels of the thinner chromium deposits, group 1 through 8, Fig. 7, follow the trend of the panels illustrated in Fig. 6, insofar as the effect of chromium plating on the depth of penetration is concerned. However, the cups on the face were not deeper than those on the back, as was found in the earlier set. This may be due to the basis metal behavior.

The tests on the heavier deposits of chromium, represented by panels 9 through 16, in Fig. 7, follow the same pattern except for the first or top cup of each panel. These top cups, identified as "T" in Fig. 7, are deeper at necking than any cups drawn on the rest of the panels cut from this sheet. The performance of these top cups in this set corresponds more closely to that on the panels tested 10 months earlier. The one-side-plated cups, marked "T," are deeper when punched on the face, the bare steel being in greatest tension. This is noted when comparing the "T" bars 10 and 14, in Fig. 7, for one-side chromium plated material. The two-side-plated test panels "T" bars 12 and 16, had cups of equal depth at necking, and significantly deeper than that of the base, although the chromium thickness was much greater on one side. However, the thickness was 50 per cent above that of the heavy deposits produced on the earlier set, shown in bars 13 and 16 of Fig. 6.

These top cups illustrate the occasional heterogeneous character of localized areas along the direction of rolling in strip steel, as discussed earlier. In this case the penetration before fracture was significantly greater for all top cups than any other punched from panels cut from this length of steel. Variations of this type may extend only a few feet or throughout an entire coil of this premium grade steel. The domes punched from these chromium plated panels had the same nodular appearance as those of the unplated steel.

METAL FINISHING IN EUROPE

(Continued from page 54)

The familiar dark blue cobalt primer was applied to all parts which were to be porcelain enameled.

Considering that all final assembly operations required individual worker attention, the assembly line ran relatively smoothly and rapidly. The final product had a good "sales appeal" finish, rivaling many of the best found on American products.

Acknowledgements

Many thanks go to all suppliers, consultants, employees of metal finishing shops, and personnel of universities who offered their services while we visited them in Europe. Without their assistance, patience, cooperation, and kindness, our visit would have been a dull and futile one.

Conclusions

1. The dynamic ductility machine serves to indicate the effect of electrodeposits of copper, nickel, chromium, and brass on the fabricating properties of sheet or strip steel.
2. Ductile brass, copper, and nickel electrodeposits tend to increase the depth of draw of low carbon, cold-rolled strip or sheet steel.
3. Unbuffed copper, brass, and nickel deposits tend to reduce the depth of draw of the basis steel immediately after plating.
4. Aging tends to increase the depth of draw of unbuffed ductile deposits to values approaching that of buffed deposits.
5. Buffing usually improved the depth of draw of deposits on low carbon steel, except in the case of some deposits from bright or badly contaminated baths.
6. The thickness of ductile deposits does not affect the ductility of the composite.
7. Non-ductile deposits of copper, brass, bronze, or nickel tend to reduce the ductility of the composite below that of the unplated steel.
8. The depth of cup of non-ductile deposits tends to vary inversely with the thickness.
9. Chromium can be applied to ductile nickel deposits without embrittlement. Thickness of chromium deposits up to 50 millionths inch has no effect on ductile nickel on low carbon steel.

Acknowledgment

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(Courtesy of Schering AG.)
Bavarian electroplating equipment manufacturer.

Our special thanks go to *Myron Diggin* of *Hanson-Van Winkle-Munning Co.* for his considerable effort in helping us make the acquaintance of many fine metal finishing colleagues in our European tour.

German Plating Conference at Schwabisch Gmünd

By R. Pinner, Technical Editor, Electroplating & Metal Finishing, Teddington, England

A MAJOR electroplating conference held from September 30th to October 2nd was the first such event staged in Germany since 1954. Scene for the conference was the little town of Schwäbisch Gmünd in Württemberg, traditionally the seat of the German gold and silver industry, and the occasion celebrated the opening of a new building for the Forschungsinstitut für Edelmetalle und Metallchemie (Research Institute for Precious Metals and Metal Chemistry) which, under the direction of Prof. Dr. Ernest Raub, is well known throughout the world for its research in electrodeposition.

The conference was attended by about 300, and the technical sessions included nineteen papers, five of which were presented by visiting authors from abroad. At the conclusion of the Conference Prof. Raub announced plans for the formation of a German electroplating society and it was hoped that the next major conference would be held under the auspices of the new organization.

Abstracts follow of the papers presented.

TECHNICAL SESSIONS

Surface Preparation

Workshop Experience in Cleaning Metal Surfaces by Ultrasonics

Dr.-Ing. K. Fröhlich, Frankfurt.

Conventional cleaning is not always adequate for the highest requirement, and ultrasonic cleaning has become established in some fields, at first for small parts, e.g. in the watch and optical industry, later for more general work. Recently, progress has been made, particularly using low frequency ultrasonics, mainly because there is no direct effect on the dissolution of adherent dirt by ultrasonics even at high intensities. In spite of earlier statements, particle acceleration or the relative velocity between work and solvent does not play a significant part in cleaning, and the cleaning effect of ultrasonics is due to cavitation or pseudocavitation and resonance in small holes, etc. Thus, low frequency ultrasonics, which produce the cavitation effect at low intensity, are very much more economical.

Experience in the AEG factories in Germany has shown that low frequency vibrations produced by magnetostructure transducers give optimum results,



Research Institute for Precious Metals and Metal Chemistry.

e.g. on cast, lacquered or polished surfaces. Only in a few cases did quartz transducers prove of advantage. At 20kc the cleaning efficiency was 100% at 3 W/sq.cm. density, 90%, at 1.5 W/sq.cm., but plunged sharply under 1 W/sq.cm. In general, better results are obtained in aqueous solutions, than in tri-, or perchlorethylene or gasoline. Partial de-aeration of the solvent is beneficial to the cleaning efficiency and wetting is of paramount importance.

A film was shown demonstrating the cleaning effect by ultrasonics, in slow motion, of steel parts in tap water and de-aerated water.

Electrolytic Derusting

Dr.-Ing. R. Hoffmann, Berlin-Siemenstadt.

The main advantage of alkaline derusting processes are that simultaneous degreasing and derusting is made possible and that hydrogen embrittlement is largely avoided. Pumping and filtration of the solutions is of importance. Graphite electrodes are in common use today and the process is operated at 100-150 amp./sq.ft.

The author stressed the importance of good electrical contacts. Racks should be placed in the vat before the current is switched on, and removed after switching off, in order to avoid sparking. Periodic reverse current has proved useful, and heavily scaled work is frequently pre-pickled in hydrochloric acid. As the majority of solutions contain cyanide, fume exhaust is generally required and effluent treatment must be provided.

Trends in Electrolytic and Chemical Polishing

R. Pinner, *Teddington, England.*

Recent progress in electrolytic and chemical polishing was discussed. On aluminium most progress has been made recently with the proprietary type bath, the composition for which was given. The main advantage of the bath are its versatility to many different mechanical polishing, and its long life. Modern applications in the motor industry in the U.S.A. and in Europe were dealt with, particularly with reference to automatic chemical polishing-anodizing equipment and anodic coating thickness.

For brass and copper alloys, the author described progress with a dilute phosphoric acid-nitric acid-hydrochloric acid-ammonium nitrate bath operated at 35°C., and dealt with the recent introduction of baths containing arsenic which give an improved finish. The use of this process before bright nickel plating of copper alloys was dealt with.

After discussing recent developments in electropolishing zinc base die-castings, the author gave typical formulations for baths used in practical electropolishing of stainless and carbon steel with particular reference to the phosphoric-sulphuric acid baths, similar baths containing aniline, and recent Soviet and Polish work on the control of electropolishing baths for carbon steels, based on phosphoric-sulphuric-chromic acid solutions.

Other solutions which have come into practical use were dealt with, including the Marshall process for chemical polishing steel, a chemical polishing bath for stainless steel, and the replacement of chromic acid in electropolishing baths by inhibitors which do not yield detrimental decomposition products.

After a discussion of some special applications of electropolishing, including machining, wave guides and wire thinning, the author dealt in detail with methods of regenerating various chemical and electropolishing solutions using chemical precipitation, electrochemical methods and ion-exchange.

Plating Processes

Experiences with a Bright Nickel Plating Bath Without Wetting Agents

Dipl. Ing. G. Buss, *Sindelfingen.*

In using nickel plating baths with organic brighteners, the properties of the deposits deteriorate with the age of the bath, due to an increase in internal stress and reduction in ductility. By the use of activated carbon treatment, the solution can be brought back to normal operation. Only recently, however, has continuous filtration with carbon been made feasible. Previously, due to the strong adsorption of wetting agents and earlier brighteners, carbon treatment had to be carried out on the whole of the solution.

The Daimler-Benz works has had 5 years' experience with two proprietary baths, plating at 100 amp.hr./liter per month. While with one bath approximately a quarter of the volume was treated weekly, the other often required treatment of the whole solution, and additional treatment with potassium permanganate 2 or 3 times a year.

In 1958 a newly developed bath was put into opera-

tion, which did not contain a wetting agent and could be filtered continuously over activated carbon. This 4,400 gallon bath was used at an average of 410-450 amp.hr./gal/month using approximately 1 Kg. carbon a day. After 4½ months no deterioration of properties had occurred and over 13,000 gallons have now been converted.

The air used for agitation is cleaned in a 3 stage filter (candle, carbon and Kieselguhr). Air agitation causes evaporation to go up to 5.5% of the solution per day and the bath requires 160,000 K/cal. heat/1000 gallons per day. A drag-out reclaim tank is made up with deionized water. 70 g. iron are dissolved from the 220 lbs. of nickel anodes used daily. This is held in solution by adding sodium fluoborate and is deposited at low current densities. The filtration system changes the bath once an hour.

The advantages of the bath are that it gives deposits of constant, high ductility and low stress, no periodic regeneration is required, and current density and coverage of chromium on the deposit are improved. Disadvantages are somewhat higher cost in equipment, heating, air, and filtration.

Recent Progress in Chromium Plating

Dr. H.-J. Brinkmann, *Detmold.*

A review of the history of chromium plating was followed by a discussion of current trends in decorative chromium plating. Chromium deposits are now regarded as contributing significantly to the protective value of the nickel-chromium system.

About ten years ago, the self-regulating chromium bath was developed in the U.S.A. in which the catalyst concentration is maintained automatically. At first the bath was used mainly for hard chromium but, later, this development also led the way to the use of mixed catalyst electrolytes in decorative plating, a practice which had been well established in Germany for some years. Deposits are of particularly fine grain size and have proved to have an improved corrosion resistance. More recently a solution was developed which gives a bright crack-free decorative chromium deposit, which gave a further improvement in protective value. The latest trends have been a general increase in thickness of chromium deposits and the introduction of the duplex chromium plating process in which a crack-free deposit is followed by a 'cracked' deposit. This again improves the protective value of the deposit to a point where the chromium makes a significant contribution to the corrosion resistance of the system.

In the discussion following this paper various speakers dealt with work in Germany during the last war with fluosilicate and fluoride electrolytes which were used under conditions basically similar to the U.S. process.

Problems in Brass Plating

Dr. H. J. Ehrlich, *Wolfenbüttel.*

After a review of the chemistry of brass plating solutions and the factors influencing color, the author described a number of new developments. In the analysis of brass plating solutions, the results can be obtained rapidly by the use of ion exchange resins. Brighteners used in brass plating baths include

nickel carbonate, arsenic acid, and ammonium salts. Ammonia is frequently added to maintain the color and it has not yet been found possible to replace this by a less volatile compound. The effect of low aliphatic amines, substituted heterocyclic compounds, and sulphur compounds was discussed. Radical improvements in brass plating must await the development of better complexing agents and more stable brighteners.

Electrodeposition of Rhodium with Special Reference to the Production of Crack-free Deposits

F. H. Reid, *London, England.*

The author reviewed the reasons for the occurrence of internal stress in rhodium deposits, and reported on recent work on the effect of aluminum and magnesium sulphate and selenic acid on the properties of rhodium deposits.

If small amounts of selenic acid and sulphuric acid are added to the sulphuric rhodium plating bath, this facilitates the deposition of rhodium deposits which are bright and smooth up to a thickness of 2 mil. A fine crack structure could be observed on the surface which, on polishing and electrolytic etching in potassium cyanide solution, is somewhat deepened.

A mechanism for the action of selenic acid additives was discussed and results were quoted showing the improved protective value of deposits obtained from solutions containing the addition agents.

Special Applications

Electroplating Processes in the Production of Tin Plate

Dr. W. Hoare, *Tin Research Institute, London, England.*

Electroplating began to replace hot-dip tinning in the production of tinplate during the last war, and today approximately 78% of the world output of tinplate is produced by this method. The main differences between electroplating and usual plating in still baths consists in the fact that steel strip up to 10 ft. wide can be plated continuously at speeds of 2000 ft./min. or higher, and that deposits of considerably lower thickness, i.e. between 0.015-0.6 mil are applied.

Mechanical aspects pose the main problems in the development of electroplating units, e.g. the electroplating cell of the installation requires very high currents, up to 230,000 amperes, and plating conditions obviously differ greatly from those in still baths.

In the cycle of the electrolytic tinplate lines the first step is the mechanical entry section (continuous loading of the steel strip) followed by chemical surface preparation (cleaning and pickling with a.c. in sulphuric acid, for example), the strip is then led into the plating cell, after which the deposit is flow-brightened, passivated, and oiled before being subjected to mechanical cutting and sorting. This sequence is identical for the three main types of plant using halogen, sulphate, or stannate electrolytes, which differ only in solution and the conditions in the plating cell itself. Not all tin plating plants are very large. In Germany, for instance, there are a number of small and highly adaptable installations.

A recent development in German electroplating is the use of fluoborate plating solutions which can be operated at particularly high current densities. In the U.S.A. and in Gt. Britain, this solution is not as yet competitive due to the comparatively higher cost of the chemicals involved.

Principles of Barrel Plating

Dr.-Ing. J. Hofmann, *Munich.*

The factors which influence the choice of barrel plating as against tank plating are that the number of parts to be treated must be sufficient, the parts must not adhere when in motion and must not be easily distorted, and must neither be too heavy nor too light in weight to prevent good contact.

In general, barrel plating is not very suitable for parts which are plated to close tolerances, as the scatter of deposit thickness is likely to be wide. Nor is the process suitable for applying very thick deposits, as the rate of deposition is generally low. Both mechanical and chemical surface preparation can be carried out in barrels.

Modern barrel plating equipment frequently combines the advantages of earlier open-ended and immersed type barrels and, for the highest outputs, semi- and full-automatic barrel units are available which include all pre-treatments in the cycle.

Chromium plating requires special barrels due to the problems involved in maintaining electrical contact required for the high current densities.

The load should be adjusted so as to obtain a rolling motion rather than a continuous fall in the barrel. Typical operating conditions and solutions for barrel plating were briefly discussed. The best drying methods were by centrifuging or by water displacement in perchlorethylene.

Electroplating Problems in Electroforming

P. Spiro, *London, England.*

Not many metals can be used for electroforming. Chromium is unsuitable due to its hardness and brittleness, iron is generally too soft and too easily oxidized. In practice, therefore, the choice is normally restricted to nickel and copper. While conventional plating baths for these metals can be used for electroforming, a number of modifications have recently been introduced, designed mainly to improve the properties of the electroform.

A major problem in electroforming is internal stress. While stress-relieving agents are often added to solutions, their decomposition products sometimes tend to cause brittle deposits and this is particularly undesirable where the electroform is heated in service. Metallic impurities may also increase stress. To some extent stress can be reduced by using superimposed a.c. on d.c., but this is generally detrimental to the throwing power of the baths.

Sulfamate baths give the least-stressed deposits but best results are obtained in the absence of chlorides when, again, the throwing power is poor. Some improvement can be effected by using solutions of very high nickel sulfamate concentration. In the Watts bath, low nickel and high chloride concentrations, together

with a critical chloride:sulfate ratio, give the best results.

In copper plating, P. R. plating gives excellent deposits, despite a considerable reduction in plating speed. The improvement in throwing power and physical properties often render the process worthwhile. Brighteners are not always safe to use, e.g. in the copper cyanide bath co-deposited sulfur may prevent efficient soldering of the electroform. The author described a "throwing power box" in which not only throwing power is measured, but the angle strength of electroforms can be determined. The latter property, an important one, is improved by using levelers in the plating bath.

P.R. is not so successful in nickel plating though, if complex nickel baths are developed, it may also be expected to give a significant increase in throwing power.

Printed Circuits by the Phillips 'Transfer' Process

Dr. Ing. P. Baeyens, *Eindhoven, Holland.*

Printed circuits are normally produced by etching a copper foil-clad plastic backing. This process, however, suffers from the disadvantage that 60-75% of the copper is wasted and the copper foil is not always easy to obtain.

Since 1956 Philips in Holland have had a process in operation by which the circuit is produced on a separate carrier and is transferred to the plastic during the hard paper fabrication. This gives a substantial saving in material, though a disadvantage of the process is that it results in a less uniform copper layer than is produced by the foil technique.

The process and equipment were described in detail. The preferred electrolyte is the copper pyrophosphate bath, as this gives denser deposits which are substantially non-porous at a thickness of 0.08 mil and require only half the deposit thickness required when using other electrolytes. The throwing power of the electrolyte is important and care must be taken to use the optimum operating conditions.

Electroplating of Magnetized Parts

Obering K. Sommer, *Solingen, Merscheid.*

In operations as machining, grinding, and polishing, steel parts tend to become more or less strongly magnetized. Steel particles of various sizes which adhere to the surface may then cause roughness in subsequent electrodeposits. The author gave a number of practical examples of this type of roughness, particularly on bumpers and other motor components.

Steel may also become magnetized in automatic plating units due to the relative movement across the electric field. Recently, it was found that nickel particles originating from the anodes became attracted to the magnetized steel parts, causing rough nickel plate.

Magnetic iron particles may be removed from the surface in the cleaning stage, e.g. by the use of permanent magnets. The attraction of nickel particles to the steel in the nickel bath itself is avoided by applying a copper undercoating which acts as a magnetic barrier.

Deposit Properties and Tests

Determination of Micro- and Macro-Throwing Power of Electroplating Solutions

Prof. E. Raub and Dipl.-Phys. K. Müller, *Schwäbisch-Gmünd.*

The distribution of electrodeposits was measured on differently shaped parts with reference to macro- and micro-throwing power and leveling. The present state of knowledge of these three different properties was discussed, and experiments described in which potentiostat-controlled, stationary cathode, potential-current density curves were obtained. The plane surface of the test electrode was altered by fitting glass tubes 4 mm. dia., 1.5 and 10 cm. in length or 1 mm. dia. 1 and 2 cm. in length. The curves were shifted to a less noble potential by increasing the length or decreasing the diameter of the tube, and variation of the curve from the normal was shown to depend on the solution composition. The current distribution is measured by two such cathode potential-current density curves, e.g. using the plane electrode with and without a 10 cm. tube.

Cyanide copper and silver plating baths have a better current distribution than acid copper and nickel solutions. By determining this and the cathode efficiency of the relevant current densities, the throwing power can be determined. Thus, while cyanide copper and silver baths show almost the same current distribution, the throwing power of the latter is better because its cathode efficiency decreases more sharply with increasing current density. Similarly, although the Watts nickel bath has a better current distribution than the acid copper bath, the throwing power of the two solutions is approximately equal because the cathode efficiency of the nickel bath increased with increasing current density.

Comparative tests with a Watts nickel bath and a proprietary bright nickel solution showed that, in the latter, a considerable diffusion inhibition takes place when a 1 mm. dia. tube was fitted to the electrode. This is a micro-throwing power effect leading to leveling in the recesses of micro-profile of the surface. On the other hand, in macro throwing power, the Watts nickel bath is superior.

Comparative Corrosion Tests on Chromium Plated Parts

W. Nohse, *Lippstadt.*

After an introductory review of the mechanism of corrosion in electrodeposits, the author reported on a test program using the Corrodokote test, the Kesternich SO₂ test, and outdoor exposure tests on copper-nickel-chromium plated steel parts. Photomicrographs showed the onset of corrosion pits at various stages of exposure and established good correlation between outdoor exposure and both the accelerated tests, though the Corrodokote test results were not as easily recognizable as those for the SO₂ test. The results tended to show that the corrosion resistance of the chromium deposit is possibly of more importance than the copper or nickel deposits in determining the service life of the coating system as judged by appearance, and

emphasized the merits of crack-free chromium coatings.

In the discussion that followed Dr. Hefele showed pictures illustrating fine structural cracks in chromium deposits as distinct from large-scale cracking which occurred either during bending or heating of the plated part, or in service under the influence of corrosion.

Non-destructive Thickness Testing with the Interference Microscope

W. Illig, *Oberkochen*.

This was a brief contribution in which the author described the determination of thickness of transparent coatings, e.g. anodic coatings on aluminum, with the aid of the interference microscope.

Pores in Electrodeposits

Dr.-Ing. A. Kutzelnigg, *Nuremberg*.

The author defined pores in electrodeposits as cavities filled with air or other foreign matter, e.g. other gases, liquids, or solids. Pores were classified into continuous pores and masked pores, the latter starting either at the surface or at the basis metal/coating boundary. In size they may vary from macropores, seen with the naked eye, to small micropores, which can only be seen under the electronmicroscope. The causes of porosity were reviewed in terms of the properties of the basis metal surface, local covering power, properties of the electrolyte, inclusions, and the effect of after-treatment.

The Ferroxy test was discussed in some detail, and experiments on nickel coatings and nickel foil were described which showed that both this and the hot water test did not give valid results, due to the aggressive nature of the reagent solutions on the deposit.

Plating Abroad

American and German Methods in Electroplating

Dr. L. Hartinger, *Düsseldorf-Neuss*.

The author gave a brief report of U.S. methods and compared these with German electroplating practice. After describing the greatly superior facilities for development work in the U.S.A. compared with the European industry, he referred to recent developments, particularly in respect to multiple coating systems and, in particular, the three processes: duplex nickel and duplex chromium, and chromium-nickel-chromium coatings. In duplex nickel the aim was to use a basis metal surface, the roughness of which should not exceed 50 micro in., applying an 0.5-1.5 mil coating of semi-bright and 0.1-0.3 mil fully-bright nickel. Chemical brightening of aluminum and automatic plating machines was also dealt with.

In the U.S.A., a new trend seems to be the use of medium size and small automatics, which have become established in small industrial plants and in contract plating shops. He gave one example of a contract plating firm, employing 100 people, which operated five automatics, for copper-nickel-chromium, barrel cadmium, and bright anodizing. This trend was

illustrated at the exhibition which accompanied the recent 5th International Conference at Detroit. The author referred briefly to developments in abrasive blasting, particularly for jet aircraft components.

In the discussion Dr. Nohse showed slides demonstrating the mechanism of corrosion in multiple coating systems. Dr. Summer pointed to the larger use of electrolytic and depolarized anodes in the U.S.A., while Dr. Gebauer pointed to the fact that U.S. metal quality was, in general, superior to European and required less surface preparation. It was often useful to choose a larger automatic plant than strictly necessary and allow for a rest period. In Germany, too, the trend was towards smaller automatic plating units, and those incorporating programming. However, in Germany, more than in the U.S.A., customers seemed to require their plants to be custom built and a mass produced unit was less successful.

Electroplating in Japan

Dipl.-Chem. A.v. Krusenstjern, *Schwäbisch-Gmünd*.

The author described experiences in a recent trip to Japan where the electroplating industry has made very considerable progress since the war. There are in Japan between 2000-3000 electroplating departments employing, on the average, 10-15 people. One of the most significant factors is the large-scale development of barrel plating. Imitation of Western equipment had almost ceased. On the other hand, automatic plating machines are seldom seen, due to the ready availability of fairly inexpensive and intelligent labor, and only one German automatic had yet been sold in Japan. Plating shops, on the whole, are very well equipped, and even small shops are fitted out with apparatus for chemical analysis, metallurgical microscopy and micro-hardness testing. There is close contact between practical platers and scientific institutes, and the industry as a whole is ready to accept any improvements suggested by technologists. This does not apply only to the directors of companies but even to the foremen and plating operators.

Design for Electroplating

Prof. G. Oehler, *Düsseldorf*.

Design for electroplating is inevitably connected with standardizing deposit thickness and properties. It is essential, therefore, that the designer have a clear idea of the requirements of the plating shop when a product is on the drawing board.

The future of decorative electrodeposits was reviewed in terms of color, brightness, hardness, and corrosion resistance, and the influence of design on these factors was briefly discussed in relation to uniformity of the deposit, mechanical surface preparation, racking, drag-out, and air bubbles.

Parts should be plated in the assembled stage wherever possible. If tolerances are prescribed, the deposit thickness must be adapted to these and to the metal removed by polishing. Screws, rivets, welded and soldered joints were discussed in relation to design. It was emphasized that, before the final stage of design, the electroplating specialist should be consulted.

Science for the Coatings Technologist

Part XIV. Additives: Surfactants

By E. S. Beck

This is the second and concluding installment of Part XIV. The first installment appeared in our November 1959 issue.—Ed.

Applications: General

HAVING considered something of the background of theory concerning surfactants, we are now in a position to look into their uses and application in the paint and related industries. So much information on the chemistry and physics of these materials has been accumulated that one might hope that surfactants could be selected for specific jobs by a review of their characteristics against the requirements for a specific job. While some progress has been made in this direction, the compounder usually must depend, in the last analysis, upon trying a number of possibilities, and selecting the most promising. Under the subject of emulsions, we will look into one or two theoretical methods of selecting surfactants which work, in the main, remarkably well.

In general, the quantities of surfactants used in most applications are quite small. A good surfactant will show a noticeable action on surface tension in amounts as low as one-hundredth of one per cent. Quantities as small as this are frequently used, especially in the case of the silicones. Other applications may run up as high as 2 or 3 per cent, as in the case of emulsifying agents. It is very rare that quantities much in excess of these are used.

If larger amounts of surfactants are used than are actually necessary, many actual or potential disadvantages can be encountered. First, there is the simple matter of cost. These agents are, in the main, expensive. High dosage will result in high costs. Another drawback is the possibility of reduced water-resistance. With anionics in particular, this potential weakness must continually be borne in mind. These materials are so water-soluble and such good wetters and detergents that they can markedly increase the susceptibility of the film to water penetration. Of course, sometimes the water-sensitivity of surfactants is reduced in the ultimate film by reaction with other components.

Excessive quantities of emulsifiers, added in a mistaken hope for improved safety and stability, can sometimes decrease stability. This is because, at least in the case of emulsion polymers, larger particles are produced, sometimes even to the point of gum for-

mation. With emulsified oils and the like, once adequate dispersion has been obtained, further additions of emulsifying agent over a fairly wide range seem to have little effect, either deleterious or advantageous.

Another possibility is the encouragement of foam or lathering. This is in itself a dispersion of air in liquid. Many of the better dispersing agents, particularly the anionic types, have a bad tendency to foam. This foam, once formed, is not easy to break. We will go into foam-breaking a little further on. At this point, it is simply necessary to make the point that the amount of foaming is dependent in part on the quantity of surfactant present. It is advisable to keep the risk as small as possible by using as little surfactant as is practicable.

It is interesting to look over the entire field of surfactants and see how production of different materials breaks down into categories. Gantz, quoting McCutcheon, points out that, of over 1600 materials listed by trade names, more than half are anionic, one third are non-ionic, 11% are cationic and less than 1% are amphoteric.

Gantz continues with a brief analysis of salient features of each class of surfactant, from the point of view of rapid identification. Non-ionics are usually oily liquids or low-melting waxy solids showing only a trace of ash.

Powdered materials are likely to be anionic. Very high foam products are probably anionic. Anionics are often reduced with inorganic salts, which would not be soluble in alcohol or xylol.

Cationics are often sold as waxy pastes, containing water, alcohol or both. Cationics are readily fixed to the surface of cotton fabric, imparting a soft, slippery feel.

Wetting Agents

Certainly one of the first uses for surfactants was for wetting. It is essential in the dyeing of fabrics that the surface be well and uniformly wetted. This is not easy to accomplish, so it is not surprising that so much time and work was expended on developing surfactants for textile use. This remains an extremely important outlet for surfactants, and much of the research on new products is still directed in this field. Many of the standard evaluation tests, and even some of the terminology of surfactants is derived from textile work. Turkey red oil, a sulfated castor

oil (often mistakenly called a sulfonated oil) was one of the very first synthetic wetting agents, if not the very first.

Turkey red oil is still occasionally used in coatings work. Its name indicates that it is used in the dyeing of Turkey red, an example of the ubiquity of textile terms in surfactant chemistry. While the wetting properties of Turkey red oil remain respectable, it has been far surpassed by the newer anionics, many of which remain sulfates, and are actually to be considered technical descendants of that early material.

There are numerous places where wetting is important in paint technology. Most important, no doubt, is the wetting of a pigment by a vehicle. Before a pigment can be dispersed in a vehicle it must first be wetted. This can take a surprisingly long time, if it is not assisted. Gardner² points out that carbon black, ground into linseed oil (bodied) on the roller mill is still not completely wetted out after standing for six months. This is an unusually slow pigment for wetting, however.

It is this fairly slow wetting process which is behind the old-fashioned procedure of "sweating" roller mill pastes for one to as much as seven days before grinding them. The components of the paste were mixed, and allowed to stand this period of time before using them. It was found that the grinding proceeded easier, to a better end point, and with much less time. The "sweating" period gave the vehicle time to wet the pigment, at least to a large extent.

If work is done on the paste, such as agitating it while in a state of high viscosity, the wetting process is hastened. While very few paint manufacturers today "sweat" batches (excepting putty, which is still "sweated") because of the time involved; many do intensively mix pastes before grinding on the roller mill. Some dispersion is also obtained in this way, of course. But in both "sweating" and intensive mixing, at least one pass over the roller mill is eliminated. Using a fresh, unworked paste on the roller mill means, in practically all cases, that the first pass is just a mix for wetting purposes before the grinding can proceed.

The surface of some pigments is hydrophilic, hence easily wet with water. Others are lipophilic, or easily wet with oils. Now that paints are made in large volume both in oil and in water vehicles the old generalizations no longer hold. When all paints were in oil or other organic vehicles and solvents, the problem was to wet hydrophilic pigments with oil. The hydrophilic pigments are the whites, most extenders, yellow and red iron oxide, carbon black, chrome yellow. Most organic pigments are hydrophobic (same as lipophilic) in the toner form. Iron blue does both, depending on its surface preparation.

Gardner² suggests lecithin, a non-ionic, as a useful wetting aid for all pigments except carbon black. For carbon black he prefers iron naphthenate or copper oleate. Other good general-purpose wetting agents are the soaps. Zinc resinate is one of the oldest materials used for wetting purposes, and it is still very good in many cases. The naphthenates and octoates and talates of certain metals are quite useful as wetters, also. The zinc soaps are the most widely used, but

occasionally the iron, copper and calcium soaps are used.

One cannot draw hard-and-fast generalizations about wetting properties. In water, the lines are undoubtedly firmer. But in solvent systems, in many, if not in most cases, hydrophobic and hydrophilic pigments can be improved in wetting properties by the same wetting agent. Anionics are the best wetting agents, and are quite widely-used as wetting aids for pigments. This aspect of the problem is still fundamentally one of trying a number of materials, and selecting the best for the purpose. Many laboratories have found, over the years, that certain materials are of use for certain types of applications; making it simpler to choose without elaborate testing.

Daniel,³ feeling that the search for a single agent valuable for all applications was hopeless and that the formulator could not be expected to conduct a research program for each new dispersion, sought to develop a broad-spectrum agent. This was not necessarily effective in every case, but to be useful in many. It was not aimed at being the highest in activity, but at being at least useful.

Out of the research conducted by Daniel came a "non-specific" agent which is a good general-purpose wetting and dispersing agent. In spite of the avowed aim of eschewing peak effectiveness in favor of broad utility, it is found, at least in the writer's tests, that the material is extremely effective where it works, and of little value where it does not.

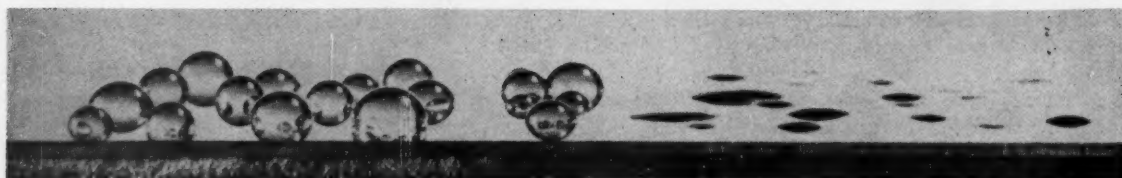
Wetting agents can reduce the consistency of pastes quite remarkably, where the high consistency is owing to poor wetting. Daniel cites the classical example demonstrated by Green many years ago. He prepared a stiff paste of zinc oxide in kerosene. Zinc oxide, being hydrophilic, is not easily wet by kerosene. To this stiff paste, a few drops of a crude wetting agent (bodied poppyseed oil) was added. The solid mass promptly liquefied.

Today, the same effect could be obtained by a trace quantity of the appropriate wetting agent. But the older materials, such as bodied oils, rosin, soaps, fatty acids, and the like, are still used in many cases. This is because they are familiar, and often similar to the vehicle being used in the paint under consideration.

Bingham⁴ recommends a number of wetting agents for use with a variety of systems. His chief attention is to the vehicle used, rather than the pigments to be wetted. The products are of two major types; non-ionic esters (both oil-soluble and water soluble) and cationic esters. The non-ionic esters are long-chain fatty acid esters of glycols. By varying the hydroxyl content, the water solubility can be varied from water-insoluble (low hydroxy). The cationic esters are the fatty acid soaps of polyetheramines.

Non-ionic oil-soluble surfactants are recommended for oleoresinous and alkyd resins in hydrocarbon solutions. They are especially valuable for styrenated alkyds with limited hydrocarbon compatibility.

Non-ionic oil-dispersible surfactants should be added to amino resin solutions before they are added to alkyd dispersions. This is claimed to reduce shock. It also lowers the observed tendency to flocculate if the amino resin is of limited tolerance for hydro-



Acknowledgments to Atlas Powder Company

Fig. 1. The effect of a surfactant on the spreading of a liquid. At left are globules of water standing on the waxed surface of a pane of glass. On right are water globules to which a surfactant has been added. Note how the water has spread out in a thin film.

carbons. These materials are also proposed for vinyl plastisols, nitrocellulose lacquers, and in the plasticizers for vinyl formulations.

Water-soluble non-ionics are used in conjunction with the oil-dispersible types where greater tolerance for polar solvents is desired. They are also used to clear up water hazing. This phenomenon is caused by the presence of internally locked water. A very small amount of the water-soluble non-ionic is reported to release this water, resulting in maximum gloss.

Cationic esters are proposed for deflocculation agents for carbon blacks and high oil absorption organic pigments. They are also recommended together with oil-soluble non-ionic esters for dispersions of fine particle size and where maximum color development is required.

Up to this point, we have been emphasizing what can be done via the vehicle to enable the pigment to be wetted more rapidly. There is, of course, a different approach, which is just as feasible. That is to pretreat the pigment so that it is more receptive to vehicles. This approach has been actively followed in recent years. Quite a number of surface-treated pigments and extenders are now available.

The types of treatments vary from mechanical processing of the pigment through conditions of precipitation to coatings on the final pigment. These coatings or surface treatments can be inorganic, organic, or a mixture of both. The first and original treatment was coating the surface of an extender (calcium carbonate) with a trace of rosin derivative. This surface-treated pigment is definitely easier to wet and disperse, and is still in very wide use today.

Some pigments are treated with the same type of surfactants which we have been considering in this article. In many cases, great improvements in wettability are achieved. Sometimes the pigment, especially organic toners of high oil absorption, is resinated for improved wetting and dispersibility. This process involves a rather substantial addition of rosin derivative and renders the pigment distinctly more transparent.

It is of unquestionable value to treat pigments in this way. However, one type of treatment cannot be universally valuable under all conditions, and in all types of vehicles. Consequently, it is sometimes necessary to use a wetting agent of specific properties even though the pigment has received a surface treatment.

We have still to consider the wetting of pigments in water-type systems. Since the majority of pigments are hydrophilic, one would think that wetting would be a rather minor problem. But the pigment cannot be dispersed in the emulsion because of the danger of breaking it. This means that the pigment must be

ground in the water, thickening agent, protective colloid, and other incidental ingredients, and added to the emulsion. Good wetting at this point becomes essential. The proper amounts of the proper wetting agent are very helpful here.

Many, perhaps most manufacturers purchase colors for latexes in the water-dispersible form. The pigment in this state is in a slurry in water and dispersing agent. It is well-wetted with water, and is easily mixed into batches with a minimum danger of flocculation.

We have spent enough time on the subject of wetting of pigments with vehicles to show what a major problem it is, and how the use of the surfactants can be valuable. But there are other places in paint technology where wetting is also important. The first of these is the cleaning of the surface itself. Metals are usually cleaned by a grease removal process of some sort (alkali cleaning, vapor degreasing, solvent washing, etc.) followed by a chemical treatment, usually a phosphating, then a final rinsing, with or without a sealing chemical treatment.

Many of the cleaning operations involve use of a wetting agent to obtain good penetration of the grease or oil so that it can be properly removed. The chemical treatment must wet the surface readily and uniformly in order to produce a standardized, non-varying surface. It is important that minimal quantities of surfactants be used to avoid leaving excess wetting agent on the surface. This might interfere with the performance of coatings subsequently applied. Hot rinses usually can be depended on these wetting agents.

Another important wetting job is for the paint to wet the surface on which it is being applied. This does not sound like much of a problem, but in some cases wetting is not easy. A common example is in the application of non-inhibiting primers on structural steel. There is frequently much mill scale and even adherent rust on the surface. For best results, this scale should be wetted and penetrated by the coating. Quick-drying paints cannot do this, because of the slowness of the wetting process. The paint has dried and lost its wetting power before the penetration is even well under way.

It is accepted practice to include substantial quantities of raw oil, bodied oil, or both, in such primers. The wetting properties of the oil are valuable in penetrating the scale. Zinc resinate and other wetting type soaps are occasionally used to advantage.

Another type of surface wetting problem is encountered in coating polished or buffed metal surfaces. Even when carefully cleaned, these frequently carry traces of waxlike substances. When the coating is applied, it tends to form a series of independent drops rather than a continuous film. Sometimes the choice

of correct solvents can bring about enough wetting to produce a smooth film. Sometimes a wetting agent must be applied, either to the surface as a rinse, or as an additive to the coating.

Further uses for wetting agents are in the preparation of flushed colors. These useful dispersions are made from pigment press cakes which are wet with water from the manufacturing process of pigment precipitation. The water is displaced by organic vehicle during a mechanical churning process. The free water is poured off the top of the mixer.

The problem here is to achieve a complete replacement of the water without flocculating or shocking the pigment in the process. The choice of the proper wetting agents, is important.

As a final example, let us look at the reverse of the wetting problem as we have considered it up to now. There are some cases where wetting is undesirable. The prime example is leafing aluminum. A minimum of wetting is essential here. If the flakes of aluminum become wetted down by the vehicle, a loss of leafing will result. To keep wetting down as low as possible, leafing pastes are treated with a substance such as acid to make wetting difficult. Anything which tends to remove, penetrate, or dissolve the stearic acid will impair the leafing. Lead compounds are particularly bad in this connection, as they form insoluble lead stearates. Highly polar liquids, such as alcohols, which are solvents for stearic acid will impair the leafing.

Emulsifying Agents

This group of surfactants accounts for the largest part of the consumption of surfactants in the paint industry. This is because of the great volume of latex products now in use. All of these are emulsions, some prepared during the polymerization of the resins, others prepared from finished, even dry resinous materials.

The principle of emulsification involves producing a dispersion of extremely small particles or droplets of one material suspended within a liquid in which it is normally insoluble. The suspended phase is known as the disperse or interior phase. The dispersing liquid is called the exterior phase. The terms "oil" and "water" are freely used in technology to describe each phase. On occasion, as with foams, we get an air-in-water emulsion, where there is no oil at all. But, in general, the terminology is useful, and reasonably exact.

There are two general types of emulsions: oil-in-water and water-in-oil. The paint industry uses almost exclusively the water-in-oil emulsions. By having water as the exterior phase, we obtain materials which are dilutable with water. This is not only convenient and economical, but it leads to the further advantage of quick and easy cleaning of brushes, etc. The exterior phase of an emulsion can be diluted with itself to a very large degree before instability is encountered. The interior phase cannot be added at all, unless it is previously emulsified.

In order to prepare an emulsion, the surface tension of each constituent must be reduced. The net result is a reduction in the interfacial tension so that the materials tend to wet each other better. The inter-

facial tension is the difference between the surface tension of the two materials. In the case of water and the commoner materials emulsified in paint work, this interfacial difference usually amounts to about 30 dynes. A good emulsifying agent should bring this down to at least 5 dynes.

The most commonly-used emulsifying agents are the non-ionics. These are the most stable, and least likely to precipitate by metals or other surfactants. However, anionics and cationics are occasionally used to prepare emulsions. The soaps are widely used for simple emulsions which do not have to meet a large number of strict requirements. Some oils of high enough acid number can be emulsified by simple addition of alkali (ammonia, morpholine, or even caustic soda) followed by water.

Where both the acid and the alkaline component of a soap emulsifier must be added, it is often advisable to add the separate items individually rather than as a complete soap. The acid (rosin, oleic acid, etc.) is dissolved in the oil and the alkali in the water. The two are mixed under agitation and the soap formed as the emulsion is made.

Much better and stabler emulsions are formed, however, when the modern synthetic surfactants are employed. No emulsion is completely stable. But good emulsions can be made which show permanence for years. Where extremely fine particle size is desired, this too, can more readily be obtained by using modern surfactants. In the case of polymer emulsions, the soaps are commonly used with good results.

Once the interfacial tension has been reduced to the point where extremely fine dispersed particle have been formed under agitation, the emulsion may be said to have been produced. However, it will not be very stable unless some way is found to keep the oil droplets from coalescing as they contact each other. There are two things which are done to accomplish this.

The first is to surround the dispersed particles with a charged aura so that they repel each other. This is accomplished by means of the surfactant's polar-non-polar structure. The polar portion is oriented toward the water phase while the non-polar tends to go into the oil phase. The solubility must be such that the surfactant is concentrated at the interface without being engulfed completely by either phase. Under these conditions, an anionic agent will charge the particles negatively, while a cationic surfactant will produce positive charges. The particles of emulsified oil or resin will then repel each other on approach because of their similar charges. To a much less extent, amphoteric and even non-ionic agents will produce electrical effects. This depends upon the fact that the molecules are charged in the area of the polar group to a greater extent than in the organic area.

The other approach to keeping the particles apart is by means of coating them with a tough membrane of dispersant which is not easily broken. This works quite well, and is widely-used in emulsion technology. Most of the non-ionics have this property to some degree or other. Protective colloids and thickeners also help. In addition, these latter reduce the mobility of the dispersed particles by increasing viscosity.

HLB Concept

The HLB or *hydrophile-lipophile balance* is a means of predicting in advance which surfactant or surfactant combination shows most promise for a specific application its greatest value lies in emulsification work. That is why we take it up at this point. It was indicated above that the emulsifier must be chosen to have a balanced solubility. It must not be exclusively soluble in one of the components at the expense of the other, or it will not accumulate properly at the interface where it is needed.

Since there is such a tremendous variety of materials which might be used in an emulsion, the choice of the correct material becomes important. There is a definite measure of specificity in emulsifying agents.

The HLB system does not aid in the selection of the proper chemical family of surfactant to use. But it can be a valuable short-cut as will be shown.

The system has been published in a number of papers.⁵ An arbitrary scale is set up, where an HLB value of 1 signifies complete solubility in oil and insolubility in water. A value of 8-10 is median. An HLB of 13 or 14 indicates complete solubility in water. Many products have been measured, and assigned an HLB rating. A method is also available for computing the HLB of a new material.

According to Griffin,⁶ water-in-oil emulsifiers occur at an HLB of around 4; oil-in-water emulsifiers at around 10; detergents at 13; and solubilizers at 15.

To attack a specific problem, a pair of non-ionic emulsifiers are chosen and tried on the emulsion in a number of ratios. One of the emulsifiers should have a low and one a high HLB. Observation of the emulsions prepared will indicate the HLB which is optimum for the system. Having established the optimum, a variety of different chemical materials at this value, or blended to this value, may then be checked, and the most efficient selected as the one to be employed.

This appears to be a logical and well-developed system. Many laboratories have used it with success. It is only fair to point out, however, that some authorities consider it to be of little value.

Emulsion Preparation

The details of emulsion preparation are complex and varied. There is no need to go into them with any completeness here. Only a few important points need be made. First, a considerable amount of work usually must be done on the system to obtain a good emulsion. Second, it is almost always desirable to prepare the emulsion by inversion, when circumstances permit.

This process involves first preparing a water-in-oil emulsion, then inverting it to an oil-in-water type. The advantage of this lies in the fact that in the water-in-oil stage, the emulsion is very heavy, and receives a great deal of shear during the mixing. A second advantage is that, as the water is added to the water-in-oil emulsion to invert it, the oil phase gradually attenuates into an extremely thin film, one which is ideal for the preparation of very finely divided droplets.

Detergents

Detergents, while an extremely important class of surface-active agents, are of no special importance in paint technology. Detergency is the ability to clean a surface or, in a broad sense, to remove soil. It is a specialized property, not closely related to other surfactant properties. In other words, a good detergent is not necessarily a good emulsifier (it most likely is not, in fact).

Solubilizers

This is another class of materials which are not used to any extent in protective coatings. These are extremely hydrophilic agents which are added to oils in massive amounts. Under these conditions when water is added, a clear mixture is formed, without the milkiness which is characteristic of an emulsion.

Dispersing Agents

From the point of view of paint technology, this is an important class of materials, indeed. We mention dispersing agents at this point only for the sake of completeness. These will be considered separately in a later article in this service.

Briefly, dispersing agents aid in the formation of suspensions of one material in another. Since many of the substances dispersed are solids, the dispersing agent obviously has not dissolved or penetrated into it, but is adsorbed on the surface. Dispersing agents, therefore, must be capable of being adsorbed on the surface of the material to be dispersed.

Effective dispersing agents frequently are ionic, or at least differentially charged within the molecule. This is to keep the dispersed particles from flocculating by mutual attraction. A dispersion is of relatively little value if it cannot be kept free from flocculation and settling.

Anti-Flooding and Anti-Floating Agents

This is another group which will be considered separately in another article in this series. Anti-flooding agents are used in extremely small amounts in the paint industry. Judged by their consumption, they would be very minor material. But when a flooding or streaking problem occurs, they are of extreme value.

There are numerous materials which have some merit for this use. It is not easy to predict which will be of value in a given circumstance. The best practice probably is to have available a number of materials of different types which have been successful on other occasions. When a problem arises, several materials can be checked for efficiency, and the best adopted for the case in hand.

Anti-Foaming Agents

It is unusual that the same substances which promote foaming or lathering are also capable of reducing it. But with surfactants, sometimes the unusual is what one should expect in the ordinary course of events. In any case, the silicone oils, which can readily cause pronounced foaming if present in excessive quantities, are the most valuable materials for breaking

(Continued on page 74)

Epoxy Resin Reusable Paint Spray Masks Simplify Production

By John Delmonte, General Manager, Furane Plastics Inc., Los Angeles, Calif.

EPOXY resin paint spray masks have done much to simplify production methods and techniques by providing reusable shields with positive separations. The techniques for preparing these paint shields are surprisingly simple and may easily be conducted by any individual who is familiar with mixing and applying organic finishes. As illustrated in Fig. 1, which depicts a small toy gun to be given a contrasting finish on the handle, a shield of laminated plastic impregnated glass fibers has been prepared with an appropriate cut-out for introducing the contrasting color.

The selection of an appropriate laminating material requires a careful choice. Important factors to consider are:

1. Ease of applying and curing at room temperature.
2. Curing agents that will be harmless to the pattern being laminated and non-toxic to the skin of the individual preparing the mask.
3. Cured systems unaffected by solvents used in spraying quick-drying lacquers or enamels.
4. Laminated structures which will not scratch or damage parts to which they are fixed.
5. Reusable masks with a good life expectancy, so if they are filed or stored they may be used a year later with good fidelity.

The above requirements are reasonable and attainable providing the proper epoxy formulation has been prepared specifically for paint spray masks. With the

Illustrations courtesy of Furane Plastics, Inc., Los Angeles, Calif.



Fig. 1. Epoxy resin two-dimensional spray mask.

proper materials on hand, the steps involved in preparing paint spray masks are as follows:

Applying Release Agent: To an accurate model or pattern, apply release agent provided for this purpose. If a porous body (wood or plaster), seal first with a lacquer, dry thoroughly, and follow with two layers of release. Determine a suitable parting plane about the model to assist separation (See Figs. 2 & 3).

Estimate Quantity of Laminating Resin: To avoid wastage of material make an estimate of the quantity of laminating resin that will be required. For

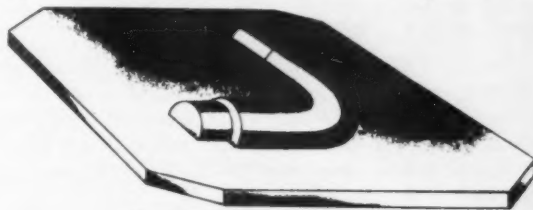


Fig. 2. Parting plane about model.

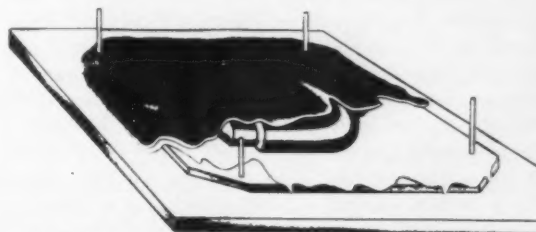


Fig. 3. Laminated material being developed over model.

a three-ply laminate, which is suggested for small structures (ten-ply for large structures) mix 0.10 pound of resin with 0.025 lb. of curing agent, a four to one (4:1) ratio by weight or volume, for each square foot consisting of three-ply. Do not mix any more resin and hardener than is planned for immediate use.

Applying Resin and Hardener Mixture: Precut three glass cloth layers so that they will cover the model against which the paint spray mask is to be prepared. Brush a layer of laminating resin on the model, and immediately follow up the first layer of glass cloth. With the fingers (preferably a rubber-gloved hand) press the cloth into the opening or over the radii, the cut-out of which is to be reproduced. Apply more resin and hardener mixture to wet the glass fabric thoroughly. Repeat for the second and third layer of fabric, following each application of glass cloth by another brush coat of resin and hardener.

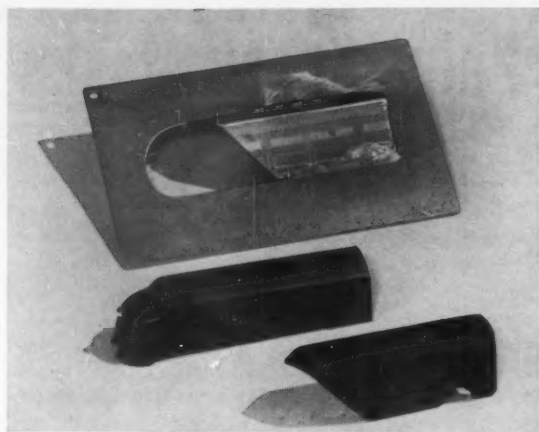


Fig. 4. Electroformed spray mask (top) and epoxy resin two-dimensional mask (bottom).

Curing the Spray Mask: It is generally good practice to allow the laminated spray mask to remain overnight at temperatures of 75-95°F. to complete cure of the resin and glass cloth. Remove from the model the following day. Temperatures of 150°F. will reduce cure time to a matter of a few hours. If brushes are to be saved, or clean-up practiced, use varnish thinners such as xylene *before* the material has taken a set.

Cut-Outs: If provisions had not been made for cut-outs beforehand, proceed to layout area which is to be opened and through which spraying is to take place. Rough-cut the desired area with suitable hand or power driven saws, and file to finish dimensions expected of the spray cut-out.

In examining alternative methods for preparing paint spray masks, several techniques have been used in the past. For example, in Figure 4 an electroformed metal shield conforming perfectly to the parts being sprayed, has performed quite adequately. However, with epoxy resins in the picture the masks are functionally equivalent at a small fraction of the cost of electroformed metal. An epoxy resin spray mask shield can be prepared in a wrap-around design, allowing a certain amount of spring-back for a close fit, something difficult to achieve with an electroformed design.

What about spray masks for larger products, such as household appliances or automobile bodies? In these examples, the laminated epoxy resins have numerous advantages because of their light weight. They are formed to size about the panels or castings to be sprayed, and stiffness may be achieved with glass roving or wood strips inserted where they will do the most good. The finished laminate, equipped with handles, because of its light weight may be readily transported easily by plant personnel. When the job is finished the shields may be stored, preferably about a completed part, until ready for next use. There will be an absence of shrinkage or warping on aging among the epoxies.

Repairs and changes sometimes are found necessary in the paint shop and the question arises on how to effect the necessary changes or repairs to paint spray shields. Because epoxies bond to themselves so well, a new section may be easily laminated to an old

shield with a minimum of difficulty. This avoids scraping the spray mask and starting from scratch. They are truly reusable materials in this sense.

Good instructions, complete paraphernalia, and adequate materials spell for successful preparation of paint spray masks. Finishing departments of many industrial plants are beginning to use epoxy plastics for this purpose. Cost savings, versatility, and permanence are important features that have justified this interest.

SCIENCE FOR THE COATINGS TECHNOLOGIST

(Continued from page 72)

foams. Very minute amounts are used, and care must be taken against side-effects, such as eye-holing or cratering.

If possible, as in mixing tanks, the dilute silicone solution should be applied directly to the foam or to the sides of the tank. In this way, maximum results are obtained from the smallest possible amounts. The solution may be sprinkled, sprayed, or applied from an insecticide sprayer. In other words, the silicone may be added to the coating. There are a number of silicones which are possible to use as foam breakers. These include the oils, some of the resins, and a specially-designed foam-breaker.

Other substances are also useful as foam-breakers. Among the simple substances are mineral spirits, pine oil, butyl alcohol, and octyl alcohol. These are most effective for latex coatings, and used in small amounts, in the neighborhood of 1 per cent. They give best results if gradually added directly to the foaming surface.

Parenthetically, the best thing to do about foaming in latex products is to avoid it from the start. The whole production procedure should be designed for this purpose. A minimum of stirring or other agitation should be performed on the batch. Critical liquids should be pumped or flowed into other liquids by means of pipes below the surface. If necessary, de-foaming vacuum apparatus should be installed on the filling line or other points where most needed.

There are also a substantial number of antifoaming agents of a proprietary nature which are offered by perhaps a dozen manufacturers. As is always the case in a situation like this, some work well in a given case and some in another.

Most formulators consider it good practice to include from 1/4 to 1/2 per cent of a suitable anti-foaming agent in latex formulations. This helps to keep down excessive foaming during factory operations such as grinding, mixing, shading or filling.

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Science for Electroplaters

54. The Rochelle Salt Bath

By L. Serota

This is the second half of Part 54 of this series. The first half appeared in the January issue.—Ed.

Insoluble Anodes

Since insoluble anodes are commonly used as part of the anode area in copper cyanide tanks, Graham and Read investigated the behavior of iron and nickel as anodes, when used alone and in combinations of each with copper, in respect to polarization and limiting values of current densities. Bath 1 in Table 2 was used for this investigation. The results are aptly summarized in Table 3. In the column labeled anode current density, the symbol $>17<29$ indicates that the anode polarized excessively at a current density greater than 17 but less than 29 amp./ft.². The data reveal the fact that anode current densities in excess of 50 amp./ft.² are permissible in copper plating from a bath listed in Table 3, without excessive polarization, provided part of the anode area is iron or nickel. An insoluble anode area equal to 5 per cent of total anode area was found satisfactory.

Additional information revealed by this study indicates that, up to a current density of about 60 amp./ft.², the copper carries all the current and the iron none but, at the current density corresponding to the limiting value for a copper anode alone, the copper and iron each carry about 50 per cent of the total current.

Another phase of the insoluble anode considered was the question of loss in weight during polarization runs as a means of determining perhaps whether iron contaminating a Rochelle-salt copper bath could be traced to the iron tank or to iron containers frequently

in contact with ball copper anodes. Results summarized in Table 4, with both numbers referring to Table 2, indicated that little or no attack on the iron anodes occurred about a pH of 10.7, except in carbonate-free baths. Operating a Rochelle salt type bath with or without carbonate at too low a pH will likely cause attack on both anode containers and iron tanks.

The data in Table 3 and 4 also show that: copper anodes polarize excessively at current densities as low as 20-30 amp./ft.²; insoluble anodes do not polarize even at high current densities; insoluble anodes used together with copper anodes tend to cause depolarization of the copper anode, thus permitting higher current densities; below a pH of 10.7 insoluble iron anodes are attacked, especially in the absence of carbonates; iron, as a contaminant in the plating tank, effects analytical control but does not affect the plating operation.

Table III. Limiting Values of Current Density for Various Anode Materials in the Rochelle Salt-Copper Bath No. 1

Anode Material	pH	Anode C.D. a./s.f.	Polarization		Bath Voltage Volts
			Fe or Ni Volts	Cu Volts	
Copper (Cu)	12.8	$>17<29$..	1.4	..
Iron (Fe)	12.8	>96	2.4
Fe-Cu Together	12.8	>47	2.3	2.6	4.0
Fe + Cu Parallel	12.8	>47	2.35	2.45	3.1
Nickel (Ni)	12.8	>96	1.3	..	3.3
Ni-Cu Together	12.8	>96	1.6	..	3.3
Copper (Cu)	10.7	$>24<28$..	1.85	2.7
Iron (Fe)	10.7	>96	1.8
Fe-Cu Together	10.7	>96	2.4	2.7	4.8
Fe + Cu Parallel	10.7	>84	2.4	3.0	..
Nickel (Ni)	10.7	>96	1.65	..	3.8
Ni-Cu Together	10.7	$>71<96$	1.75	2.25	3.9

Table IV. Loss in Weight of Insoluble Anodes in Rochelle-Salt Copper Baths at Various Values of pH.

Bath No.	pH	Anode Material ¹	Loss in Weight ² gms./sq. ft.	Na ₂ CO ₃ oz./gal.
1	12.8	Fe and Cu in parallel	0.14(Fe)	2.0
1	10.7	Fe and Cu in parallel	0.29(Fe)	2.0
1	12.8	Fe	0.00	2.0
1	10.7	Fe	0.77	2.0
1	12.8	Ni and Cu tied together	1.29(Ni)	2.0
1	10.7	Ni and Cu tied together	5.52(Ni)	2.0
1	12.4	Ni	0.00	2.0
1	10.7	Ni	0.24	2.0
2	12.8	Fe	0.00	2.0
2	10.6	Fe	0.29	2.0
3	12.7	Fe	0.00	9.0
3	11.8	Fe	0.05	9.0
3	10.6	Fe	0.10	9.0
10	12.8	Fe and Cu tied together	0.58(Fe)	0.0
10	9.8	Fe and Cu tied together	11.05(Fe)	0.0
11	12.7	Fe and Cu tied together	Excess(Fe)	0.0
11	11.4	Fe and Cu tied together	11.05(Fe)	0.0

¹Fe—Iron, Cu—Copper, Ni—Nickel.

²Variable current densities for 1 to 2 hours.

Anode Efficiency

A continuation of the study by Graham and Read of the Rochelle salt-cyanide copper bath included the effect of variations in pH and both composition upon current (anode and cathode) efficiencies. The bath numbers refer again to the composition given in Table 2. A current density of 16.8 amp./ft.² at 130°F. was used in the determination of anode current efficiency for baths numbered 1-9. For baths numbered 10 and 11, since carbonate was absent, the anode current density was reduced to 9.6 amp./ft.² to avoid excessive polarization. The current efficiencies were determined by a copper coulometer connected in series with the baths tested.

It was found, as shown in Table 5, that cathode efficiency is little affected by changes in pH if carbonate is present. Anode efficiency varies with pH depending upon bath composition; as

Table V. Effect of Bath Composition and pH on the Current Efficiencies of the Rochelle Salt—Copper Baths¹

Bath No.	Bath Variable	Anode			Efficiency %	Cathode			Efficiency %
		pH ²		C.D. a./s.f.		pH ²		C.D. a./s.f.	
1		13.3	13.3	16.8	1.7	12.8	12.8	20	52.3
1		12.8	12.7	16.8	44.7	12.8	12.8	30	47.2
1	Bath	12.2	10.5	16.8	67.3	12.8	12.8	50	36.9
1	Reference	11.7	10.5	16.8	69.4	10.7	10.8	20	48.6
1		10.7	10.8	16.8	72.0	10.7	10.8	30	48.7
						10.7	10.8	50	42.8
2	Free	12.8	12.8	16.8	90.8	12.8	12.8	30	27.5
	Cyanide	10.7	10.7	16.8	85.2	10.6	12.1	30	26.8
3	Carbonate	12.8	12.8	16.8	76.8	12.8	12.8	30	35.9
	9 oz./gal.	11.8	11.6	16.8	64.7	10.6	10.6	30	39.0
		10.6	10.6	16.8	62.8				
5	CuCN	12.8	12.8	16.8	60.0	12.8	12.8	30	64.3
	5.5 oz./gal.	10.7	10.7	16.8	82.0	10.7	10.7	30	63.2
6	CuCN	12.8	12.7	16.8	98.6	12.7	12.7	30	68.1
	7 oz./gal.	10.7	10.4	16.8	97.5	10.7	10.7	30	70.0
7	Tartrate	12.8	12.8	16.8	71.2	12.8	12.8	30	47.2
	8 oz./gal.	10.7	10.5	16.8	64.3	10.7	11.7	30	44.7
8	High tartrate & carbonate	12.8	12.8	16.8	67.7	12.8	12.8	30	43.1
		10.6	10.5	16.8	65.6	10.7	10.6	30	44.7
9	High copper & tartrate	12.8	12.8	16.8	85.7	12.8	12.8	30	73.3
		10.8	10.7	16.8	83.8	10.7	10.8	30	70.4
10	No carbonate	12.8	12.8	9.6	90.8	12.8	12.8	30	58.6
		11.4	10.0	9.6	57.8	11.4	12.2	30	48.0
		10.6	10.0	9.6	57.2	10.7	12.0	30	49.7
11	High tartrate	12.8	12.8	9.6	77.7	12.8	12.8	30	57.6
	No carbonate	11.4	10.0	9.6	55.6	11.6	12.2	30	49.3

Note 1: Bath compositions in Table II.

Note 2: pH values B—before efficiency determination, A—after efficiency determination.

for example, bath 1 with a CuCN concentration of 3.5 oz./gal. and bath 5 (5.5 oz./gal. CuCN) show a decrease in anode efficiency, with an increase in pH; bath 1 at a pH of 13.3 records an anode efficiency of about 1.7 per cent compared to an efficiency of 72 per cent at a pH of 10.7; while bath 5 increases in efficiency from 60 per cent to 82 per cent when the pH is lowered from 12.8 to 10.7. Changes in a Rochelle salt concentration of 8 oz./gal. show less effect on anode efficiency by variations in pH and carbonate concentration than that exhibited by the baths containing only 4 oz./gal. Rochelle salt. A low concentration of free sodium cyanide is preferred; 2 oz./gal. of carbonate is sufficient and should be present in the tank, since a higher concentration will

build up; a pH of 12.0 to 12.8 would seem to serve as the optimum range. The bath compositions and pH for the Rochelle salt-copper cyanide bath, shown in Table 6, are considered most favorable.

Cathode Efficiency

A. Hirsch in an investigation of the effect of sodium cyanide, sodium carbonate, and Rochelle salt on the cathode efficiency of a copper cyanide bath, used a solution made up of cuprous cyanide (3.0 oz./gal.) and sufficient sodium cyanide (3.3 oz./gal.) to form the soluble complex cyanide $\text{Na}_2\text{Cu}(\text{CN})_3$.

When solid sodium cyanide was added, in 4 gram quantities, to 800 ml. of the solution, until a total of 20 grams was added (corresponding to a concentration of 25 g./l.) the cathode efficiency showed a pronounced decrease. The following cathode efficiency

g./l. NaCN	0	5	10	15	20	25
Cathode Eff. %	62.0	36.0	37.5	22.0	5.0	2.65

Table VII

percents (Table 7) were obtained for increasing concentration of sodium cyanide. A copper coulometer in series with the respective copper cyanide solutions was used to determine the efficiency of each bath. A different copper

cathode was used for each run. The first usable deposit, the authors found, was obtained when 15 g./l. free NaCN was added. The others were not satisfactory.

For study of the effect of sodium carbonate on the cathode efficiency the prepared solution consisted of sodium cyanide 25 g./l. (3.3 oz./gal.), cuprous cyanide 22.5 g./l. (3.0 oz./gal.); free sodium cyanide 12.0 g./l. (1.6 oz./gal.). With successive additions of 20

g./l. Na_2CO_3	0	20	40	60	80	100
Cathode Eff. %	17.8	27.0	31.25	45.46	46.0	59.5

Table VIII

g./l. of anhydrous sodium carbonate portions until a total of 100 g./l. was added, with the excess free cyanide maintained close to a 50 per cent excess, a continued increase in cathode efficiency with each addition of sodium carbonate was obtained. The results are indicated in Table 8.

Deposits from the baths containing 60, 80 and 100 g./l. of sodium carbonate were most favorable. The addition of sodium carbonate, by lowering the resistivity of the solution (increasing the conductivity), was considered a significant factor in the decrease in cost of copper deposition. The baths were operated at 25°C. (77°F.), current density 0.2 amp./dm.², 1 volt across the cell, plating time 1/2 hour.

For the study of Rochelle salt additions, a bath of the following composition was prepared: NaCN, 25.0 g./l.; CuCN, 22.5 g./l.; free NaCN, 12.0 g./l.; Na_2CO_3 , 100 g./l. Rochelle salt was added in 20 g./l. quantities up to a total of 80 g./l. Here, too, an increase in cathode efficiency resulted ranging from 59.5 per cent for zero amount of Rochelle salt to 74 per cent when the concentration of Rochelle salt was increased to 80 grams (Table 9). The bath was operated at a current density of 0.2 amp./dm.² with 1 volt across the cell, temp. 25°C. Good deposits were obtained for each test.

As a further test, the concentrations of cuprous cyanide and sodium cyanide

g./l. Rochelle Salt	0	20	40	60	80
Cathode Eff. %	59.5	65.4	62.0	70.8	74.0

Table IX

were doubled, the free sodium cyanide was kept at 15 g./l. and Rochelle salt at 45 g./l. The bath was operated at a current density of 1.4 amp./dm.², 1 volt across the cell, temp. 54.4°C.

(Continued on page 79)

Table VI. Optimum Bath Compositions and pH

	Bath 1N	Bath 5N
	oz./gal.	oz./gal.
Copper	2.5	3.9
Copper cyanide	3.5	5.5
Sodium cyanide	4.6	6.8
Free cyanide	0.75	0.75
Rochelle salt	8.0	8.0
Sodium carbonate	4.0	4.0
pH (12.2-12.8)	12.7	12.7

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Hard Chromium on Aluminum

Question: There is a German process for hard chromium plating direct on aluminum called the "FKI" method, but we do not seem to be able to obtain any information as to details. Can you refer us to any source of same?

L. N.

Answer: The "FKI" process has been employed for chromium plating engine cylinders and employs the following procedure:

1. After cleaning, pickle for 1-2 minutes in an aqueous solution of hydrofluoric and nitric acids in molar ratio of 1.5:1, at a temperature of about 12-15°C. The fluoride film which is produced is of molecular thickness and serves as a temporary barrier against oxidation of the aluminum surface.

2. The cylinder ports are plugged with fusible alloy, and the part is racked and soaked in warm water to raise its temperature.

3. Plating is carried out in the regular chromium bath, at a temperature of 58-62°C. For the first five minutes of deposition, a current density of 350-450 amp./sq. ft. is used; this is raised to 450-650 amp./sq. ft. for the next five minutes, and then to 650-800 for the balance of the plating period.

4. After plating, the part is immersed in boiling water for 1½ hours, before drying.

Degreaser Ventilation

Question: Our solvent vapor degreaser has been loading the surrounding atmosphere with fumes which are causing complaints by nearby workers. This is an old machine, which was purchased without ventilation accessories, and our maintenance man can construct an exhaust system but needs information as to the volume of air

and size of ducts. Do you have any figures which we can go by? What we have in mind is a system similar to that on our chromium plating tank, namely, slots on the long sides.

G. D.

Answer: Local exhausts are usually designed with 1½" wide slots, with a minimum velocity of about 500-600 fpm. A ventilation rate of 50 cubic feet per minute should be obtained for each square foot of tank surface.

We would suggest that a sheet metal screen be placed around all sides of the degreaser, except the working side, to a height of about 1½-2 ft. to minimize the effect of drafts. If the machine is a very old one, the design may be such that an appreciable amount of vapor will be lost in the exhaust, so that the purchase price of a new machine could be recovered in a short time as a result of lower solvent losses during operation. Also, it must be emphasized that ventilation alone is not a substitute for proper operating procedure and location of the machine.

Nickel Electroforming

Question: I have been referred to you as perhaps being able to advise me concerning an electroforming problem. We apply 1 mil of silver to an aluminum cylinder 1-3" long, ¼-½" diam. with a bore of 1/16-¼". We then apply 20 mils copper, which is machined, and follow by approximately ⅛" of nickel from a sulfamate bath. The part is then rinsed, dried, and machined, after which we sandblast, dip in 50% muriatic acid for 20 seconds and apply another ⅛" of nickel. We desire at least 50% of the tensile strength of the base nickel but the adhesion between the nickel layers is very poor. Can you recommend any solution to this problem?

P. S. D.

Answer: The surface of nickel deposits becomes passive very rapidly and must be activated prior to application of subsequent deposits.

This activation is generally effected by a strike for ½-3 minutes in a solution of 2 lbs. nickel chloride and 1 pint muriatic acid per gallon, at room temperature, 6 volts direct current, using nickel or carbon anodes.

Another method is anodic treatment at room temperature and at 25-50 amp./sq. ft., for 5 minutes, in the following solution:

Sulfuric acid	25% by wt.
Epsom salt	50% " "
Water	25% " "

The Epsom salt is dissolved in the water before adding the acid. This method was suggested by Brune and McEnally, Jr. as a substitute for the older anodic etch in straight sulfuric acid and water, since it has the advantage of requiring lower current density and voltage.

Corrosion Inhibition

Question: Do all inhibitors act the same way in preventing corrosion of steel? We refer specifically to chromates, alkalies, and metallic inhibitors such as arsenic and antimony, which we have read about from time to time. These materials are so different in type that we suspect a number of principles are involved.

L. C. R.

Answer: Oxidizing agents such as chromates and tungstates react with the iron on the surface to produce a protective film of hydrated ferric and chromic oxides. This is known as "anodic inhibition." Alkalies, if in aerated solution, form gamma ferric oxide films which protect the underlying metal. If the solution is not aerated, addition of an oxidizing agent will serve the same purpose.

Metals like arsenic and antimony operate according to another type of mechanism, called "cathodic inhibition." The thin film of metal which deposits on the steel by displacement raises the hydrogen overpotential, which inhibits the corrosion reaction. There is still another type of inhibitor,

the high molecular weight organics, which are generally believed to act by concentrating or coagulating at the metal-liquid interface, thus providing a shield for the metal surface.

Electroless Chromium

Question: We are very interested in plating a complicated part all over with a thin (0.0003 to 0.0005) chromium plate where electroplating would be very difficult or impossible. An electroless chromium method would be of interest, but the procedure given by West was not successful. Is there any other electroless process for chromium?

W. A. S.

Answer: A patent has been issued on an electroless chromium process (P.H. Eisenberg and D. O. Raleigh, U. S. Pat. 2,829,059, April 1, 1958). The following example of a working solution was given in the patent:

Chromic bromide ($9H_2O$) 16 g./l.
 Chromic iodide ($9H_2O$) 1 "
 Sodium citrate 10 "
 Sodium hypophosphite 10 "
 Sodium binoxalate 9 "
 pH: 8-10, Temp. 75-90°C.

Aluminum Plating

Question: We are writing to request information you might have available on aluminum plating. We cannot, at this writing, find any literature on it. We have read a few articles but forgot where to locate them. Your help will be appreciated.

W. K.

Answer: There is no evidence that aluminum can be deposited from aqueous solutions, and all deposition has been from fused salt baths and from solutions of aluminum compounds in organic solvents. There have been no commercial applications, only a bit of pilot plant production at a couple of the large research institutes.

If interested in references on the processes disclosed in the literature, they can be obtained in the book "Modern Electroplating" edited by Allen G. Gray.

Sherardizing

Question: We would like you to furnish us with the details concerning "Sherardizing" on steel stampings if you can, or the addresses of sources which can provide us with same. It is our understanding that this process produces a corrosion resistant zinc coating at a very low cost, and can be

used as a substitute for zinc plating and hot galvanizing.

L. R. M.

Answer: Sherardized coatings are produced by tumbling parts in a steel drum with zinc dust at low speed and

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a temperature which is below the melting point of zinc but sufficiently high to result in alloying of the zinc with the iron base. Although temperatures of 725-825°F. are suitable, the preferred temperature is 730-750 degrees.

A mixture of 80% zinc dust and 20% zinc oxide has been suggested, the unused material being recovered at the end of the cycle, which will range from 4 to 12 hours. Coating thickness will be approximately 0.004-0.009", and of a dull gray appearance, which compares very unfavorably with electrodeposits or hot-dipped coatings.

SCIENCE FOR ELECTRO-PLATERS

(Continued from page 76)

(130°F.). A good deposit was obtained with the cathode efficiency up to 95 per cent.

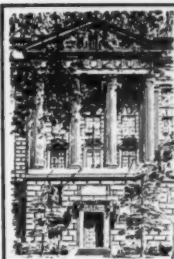
The following composition is suggested for optimum results: NaCN, 50 g./l.; CuCN, 45 g./l.; Na₂CO₃, 45 g./l.; Rochelle salt, 45 g./l.; free NaCN 15 g./l.

Leveling

B. D. Ostrow and F. I. Nobel, in a study of leveling in cyanide baths, found that the addition of tartrates (Rochelle salt) to a bath does not improve leveling appreciably. In their investigation, a concentration of 6 oz./gal. Rochelle salt was added to a cyanide bath consisting of: CuCN, 8 oz./gal.; KOH, 2 oz./gal.; free KCN, 1.25 oz./gal.

Plated panels from this bath were compared with those plated from solutions in which tartrates were absent. Results indicate that a small reduction in RMS occurs, and the reduction of the frequency of the roughness is about half the value for the bath without tartrates. The values showed an average RMS of 7.5 before plating and 11.5 after plating, or a reduction in RMS of 4 for surfaces plated from baths without tartrates; and average RMS of 5 before plating and 6 after plating or a reduction in RMS of 1 for the baths containing Rochelle salt (6 oz./gal.).

Similarly, the reduction of the frequency of roughness was 47.5 for the bath without the tartrate and 23.5 for the bath containing the Rochelle salt. Leveling measurements were made by means of a surface analyzer with a direct-inking oscillograph to record the readings.



Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Plating on Molybdenum

U. S. Patent 2,886,499. May 12, 1959.
G. R. Schaer and J. G. Beach, assignors to the United States of America

The method of protecting molybdenum articles from oxidation at high temperatures comprising, first electroplating said articles with a strike coating of chromium about .0005 inch thick, next electroplating a layer of gold about .0015 inch thick on said strike coating of chromium, and finally electroplating a layer of chromium from .003 to .005 inch thick on said layer of gold.

Copper-Tin Alloy Bath

U. S. Patent 2,886,500. May 12, 1959.
J. E. Bride, C. L. Faust and W. H. Safranek, assignors to The Battelle Development Corp.

A process for electrodepositing a copper-tin alloy comprising: passing an electric current through a bath which consists essentially of:

Grams per liter

At least one pyrophosphate selected from the group consisting of sodium, potassium, and ammonium Cuprous cyanide 8 to 300
2 to 230

At least one cyanide selected from the group consisting of sodium, potassium, and ammonium 2 to 350

At least one stannous compound selected from the group consisting of sulfate, chloride, and pyrophosphate 0 to 50

At least one stannate compound selected from the group consisting of sodium, potassium, and ammonium 0 to 250

A lead compound in an amount equivalent to lead acetate 0.05 to 0.6

A lower aliphatic carboxylic acid salt, 0.05 to 0.75 mole, said total amount of tin compounds being within the

equivalent range of from 2 to 50 grams per liter of the stannous salt.

Plating Barrel

U. S. Patent 2,886,505. May 12, 1959.
A Singleton and T. R. Gill, assignors to The Singleton Co.

In an electroplating apparatus, a rigid support, a perforated barrel mounted for rotation about a horizontal axis and having end walls with flat vertical outer faces, said end walls having coaxial internally cylindrical central openings therein, a non-rotatable stub shaft at each end of said barrel having an inner cylindrical bearing portion that fits in the opening of the adjacent end wall and an outer non-circular end portion that projects axially from said end wall and away from the barrel.

Spray Gun

U. S. Patent 2,886,252. May 12, 1959.
C. Ehrensperger

A spray gun for spraying fluid materials of different viscosity by means of low pressure compressed air.

Vacuum Metalizing

U. S. Patent 2,885,997. May 12, 1959.
J. Schwindt, assignor to W. C. Heraeus.

Apparatus for coating articles with a vaporizable coating material in a vacuum which apparatus comprises a vacuum-tight outer vessel, means including conduit means connected to the vessel for evacuating the vessel, and a substantially enclosed rotatable processing chamber disposed within the outer vessel.

Gas Plating — Aluminum

U. S. Patent 2,886,469. May 12, 1959.
E. Fitzer, assignor to Siemens-Planawerke Aktiengesellschaft für Kohlefabrikate

A method of coating metallic bodies with aluminum alloys, comprising the following steps, namely, reacting with aluminum, at temperatures within the range from above 500° C. to above

900° C., metallic chloride selected from the class of chlorides consisting of silicon tetrachloride and titanium tetrachloride contained in a hydrogen carrier gas, to produce low grade vaporous aluminum subchloride and silicon subchlorides or titanium subchlorides, respectively, and conducting said low grade subchlorides directly upon formation thereof, with said carrier gas, to a metallic body to be coated, for interaction with said body at a temperature which is below the temperature at which said subchlorides are formed, to cause deposit on said metallic body of an aluminum alloy coating.

Porcelain Enameling

*U. S. Patent 2,886,498. May 12, 1959.
G. A. Shepard, assignor to Republic Steel Corp.*

The method of preparing a cold-rolled steel article for porcelain enameling which comprises the steps of etching the article to provide surface characteristics conducive to good enamel adherence, removing all oxides from the surface of the article, depositing on the resulting surface of the article a coating of zinc of substantially uniform thickness between about 0.00001 and about 0.00005 inch, and shaping the article into final desired form while the said surface characteristics are preserved under the zinc coating, chemically removing substantially all of the coating of zinc, depositing on said article a nickel coat of substantially uniform thickness between about 0.000002 and about 0.00001 inch, applying a coating of porcelain enamel slip directly to the resulting nickel coating, and firing said slip and producing an enamel coat.

Gas Plating

*U. S. Patent 2,887,088. May 19, 1959.
H. R. Nack, assignor to The Commonwealth Engineering Co. of Ohio*

An apparatus for the gaseous metal plating of fibers from gaseous heat-decomposable metal bearing compounds.

Buff Section

*U. S. Patent 2,886,924. May 19, 1959.
A. S. Rock, assignor to F. L. & J. C. Codman Co.*

A rotary buffing element comprising an annulus of buffing material and means for supporting and positioning

the same consisting of two companion sheet metal members mechanically interlocked to provide a channel opening radially outwardly in which channel the internal portion of the annulus is received and in which it is mechanically secured.

Organic Coating

*U. S. Patent 2,887,404. May 19, 1959.
J. L. Evans, assignor to E. I. du Pont de Nemours & Co.*

A metal article having a multiple layer coating comprising an undercoat and a superposed dried topcoat of a methyl methacrylate lacquer in adherent contact therewith, said undercoat being a baked layer of a coating composition comprising as the principal film-forming material epoxyhydroxy polyether resin esterified with 1%-7.5% by weight, based on said resin, of a phosphoric acid.

Gas Plating

*U. S. Patent 2,887,089. May 19, 1959.
H. J. Homer and J. R. Whitacre, assignors to The Commonwealth Engineering Co. of Ohio*

A container source above the chamber for the retention of a heat decomposable liquid metalizing agent, conduit means connecting the container and chamber, means to heat and vaporize the liquid metalizing agent as it passes from the container to the chamber, means for introducing a carrier gas to the container source to carry the vaporized agent to the chamber, drop-forming orifice within the conduit located between the container source and chamber for confining the passage of liquid metalizing agent to be vaporized to the form of drops of the agent, and induction heating means for the heating of an object to the decomposition temperature of the metalizing agent.

Plating Machine

*U. S. Patent 2,887,210. May 19, 1959.
D. Borodin, assignor to Allied Research Products, Inc.*

A conveying mechanism of the type including a rail, a work carrier supported on said rail and a transfer mechanism for lifting the carrier at a first station along the rail, moving the carrier longitudinally of the rail in an elevated position and then lowering the carrier onto said rail at a second station along the rail.

Gas Plating

*U. S. Patent 2,887,406. May 19, 1959.
H. J. Homer, assignor to The Commonwealth Engineering Co. of Ohio*

A method of gas plating titanium on surfaces using an organo titanium compound having the formula TiR wherein R represents an alkyl or aryl radical.

Gas Plating

*U. S. Patent 2,887,407. May 19, 1959.
W. Koch, assignor to Manufacturers Chemical Corp.*

The steps comprising positioning base metal in a first furnace, positioning the coating metal in a second furnace communicating with said first furnace, positioning a halide of said coating metal in a third furnace communicating with said second furnace, evacuating said three furnaces, applying heat to said third furnace to vaporize said halide, applying heat to said second furnace to react said halide with said applying heat to said first furnace to react said reaction product with said base metal.

Chrome Pickle for Magnesium

*U. S. Patent 2,887,418. May 19, 1959.
L. Whitby, assignor to The Dow Chemical Co.*

In a process of chromate coating of a magnesium article by subjecting the article to the action of a chrome pickle solution consisting essentially of an aqueous solution of nitric acid and an alkali metal dichromate the step of admixing in said chrome pickle solution between 0.01 and 0.5 per cent by weight of a surfactant selected from the class consisting of alkylaryl sulfonates, alkyl sulfates, alkanesulfonates, halo-substituted alkane sulfonates, sulfonated esters, and alkylaryl polyether sulfonates.

Vacuum Plating

*U. S. Patent 2,887,419. May 19, 1959.
C. A. Baer, W. F. Eugbee and P. J. Clough, assignors to National Research Corp.*

The process of producing a shiny, adherent, corrosion-resistant aluminum coating on black iron which comprises the steps of exposing black iron to a source of aluminum vapors in a vacuum chamber maintained at a pressure on the order of 10 microns Hg abs. and less to deposit on the black iron a film of aluminum having a thickness

between about 1 to 30 microinches, and thereafter heating the aluminum-coated black iron in an oxidizing atmosphere at a temperature above about 350°F. and below about 700°F., said heating being continued for at least a minimum time ranging between a few seconds at 700°F. to a few minutes at 350°F. and being sufficiently long to form an iron aluminate bond between the black iron and the thin aluminum coating.

Acid Copper Bath

*U. S. Patent 2,887,442. May 19, 1959.
H. A. Van Oosterhout, assignor to N. V. Metallic Industry*

A process for the electrolytic deposition of copper, which comprises electrolyzing an aqueous solution containing an acidic copper salt, at least one mol per liter of a diamine with a boiling point between about 100°C. and 150°C. at atmospheric pressure and a saturated aliphatic monoamino carboxylic acid sufficient in amount to complex the copper, the decomposition constant of the complex being greater than that of the complex of the copper with the diamine used.

Electroprocessing Conveyor

*U. S. Patent 2,887,447. May 19, 1959.
L. E. Lancy*

An apparatus for electrically treating and advancing work articles in series progression longitudinally along and within a treating solution of a treating tank between upper and lower electrodes.

Shot Blast Machine

*U. S. Patent 2,887,826. May 26, 1959.
A. N. Schultz, assignor to Auto Specialties Mfg. Co.*

A shot blast apparatus for processing workpieces comprising housing means, means mounted for providing a stream of shot in said housing means, a stepped structure in said housing means and over which workpieces may be advanced for exposure to the stream of shot, means for oscillating said stepped structure for causing the workpieces to be advanced thereon and for exposure to the stream of shot.

Coating Spray System

*U. S. Patent 2,888,176. May 26, 1959.
J. C. Miller, assignor to Donald Menhenett*

An apparatus for dispensing a norm-

ally volatile liquid which will vaporize at room temperature, comprising: a multi-gallon container, said container having a one-way valved filling opening in a lower portion thereof, said container further having a second opening in an upper portion thereof having a pressure release valve operatively associated therewith, a siphon tube extending from said opening to the bottom of the container, and a valved conduit extending outwardly from said opening and terminating in a manifold adapted to be connected to one or more spray guns.

Spray Gun

*U. S. Patent 2,888,207. May 26, 1959.
R. E. Sykes, assignor to Bell & Gossett Co.*

A spray gun having a barrel including a delivery end and a pocket, air and liquid passages in the barrel leading to the delivery end, a trigger having one end freely rockable in the pocket, valve means at the delivery end controlling flow through the liquid passage and having a stem extending through the trigger in supporting and loose relation thereto.

Electrostatic Coating

*U. S. Patent 2,888,362. May 26, 1959.
W. A. Starkey, assignor to Ransburg Electro-Coating Corp.*

The method of coating an article comprising the steps of heating the article, creating an extended electrostatic field in a coating zone, introducing into said field and longitudinally thereof in finely divided condition a settable liquid coating material, passing said article after it has been heated longitudinally through said field generally in an opposed direction to the movement of said coating material, forcing a gaseous cooling medium longitudinally through said field generally in the direction of movement of said coating material, and depositing said coating material onto said article by said field as the temperature of said article decreases and as said article passes through said coating zone.

Plating on Aluminum

*U. S. Patent 2,888,387. May 26, 1959.
A. Wasserman, assignor to Tiarco Corp.*

A process of electroplating an aluminum article directly with chromium comprising making the article the an-

ode in a hydrochloric acid solution having a concentration of approximately 0.2 to 1.2 N and subjecting the article to approximately 3 ampere-minutes per square inch, making the article the cathode in a hydrochloric acid solution having a concentration of approximately 0.5 to 1.2 N and subjecting the article to not less than approximately 3 ampere-minutes per square inch, rinsing, and electroplating the article with chromium.

Sealing of Dyed Anodized Aluminum

*U. S. Patent 2,888,388. May 26, 1959.
F. P. Stiller, assignor to Sandoz, Inc.*

In the sealing of dyed anodically oxidized aluminum by means of a hydrolyzable metallic salt in an aqueous bath, the improvement which consists of carrying out the sealing operation in the presence in the bath of at least 0.1% by weight of, as sole sulfonate additament, a compound containing the lignosulfonate radical, whereby a smut-free product which requires no mechanical aftertreatment is obtained.

Metal Coating Process

*U. S. Patent 2,888,391. May 26, 1959.
W. F. Loughman*

The process for treating alloy steels of the class consisting of austenite and ferrite having a minimum chrome content by weight of .11 to provide a product having an abrasive resistant and acid resistant permanent coating, which comprises etching the metal in a sulfuric acid bath to produce minute surface pockets therein, washing to remove the acid, oxidizing the washed metal and thereby changing the surface color of the metal, water wetting the metal and applying a resist coating containing a protein to at least part of the oxidized metal before the metal is dry, subjecting the coated metal to a temperature of at least 400°F. immersing the metal in an electrolytic bath and finally passing electric current from the metal into the electrolytic bath to toughen the resist coating.

Vibrating Cleaner

*U. S. Patent 2,888,939. June 2, 1959.
K. P. W. Nitsche*

An apparatus for liquid cleaning or similar treatment of metallic articles with liquids comprising a polygonal shaped container having side walls,

none of which is parallel to any other, and adapted to house the liquid and receive the articles to be cleaned, means for supporting the articles within the container, at least one vibrator and means operatively connecting the vibrator to one side wall of the container to act on said wall.

Coating Metal Strip

U. S. Patent 2,888,901. June 2, 1959.
H. W. Nieman and G. O. Maisch, assignors to Bethlehem Steel Co.

An apparatus for applying a liquid coat to strip material.

Electroforming

U. S. Patent 2,889,258. June 2, 1959.
S. Fialkoff, assignor to Camin Laboratories, Inc.

The method of forming a hollow body having an inner wall lined with a metallic layer, said layer being of a smaller thickness in one annular section of the body and of a greater thickness in another annular section thereof, which comprises the steps of providing a mandrel dimensioned to conform to the interior of said body, electro-depositing on said mandrel a metallic coating to a depth equaling said smaller thickness, masking an annular portion of said coating corresponding to said one annular section of the body, electro-depositing on the unmasked part of said coating an additional amount of the same metal until said unmasked part has reached a depth equaling said greater thickness, subsequently molding a resinous shell around the coated mandrel, and removing said mandrel while leaving said shell intact.

ABSTRACTS

Permeability and Chemical Resistance of Cold-Hardening Finish Systems

Paper read at European FATIPEC Congress, Lucerne.

The connection between water-vapor permeability of cold-hardening lacquer coatings and functionality, the chain length, the quantity of hardening agent and incomplete polymerization, finally, the pigment content of the finish, were discussed by M. F. Kooistra.

The work was conducted to provide a theoretical basis for an explanation

of the resistance to chemical agencies. The films have good resistance to water and to acids and an outstandingly good resistance to alkalis. The condensation products are somewhat dark-colored but lighten during the film drying. All colors can be obtained with these finishes, except white.

Epoxy Resin Ester and Alkyd Finishes

Paper read at European FATIPEC Congress, Lucerne.

Details were given by P. Castan and C. Gandillon of tests made with epoxy resin esters and alkyd resins, built up on dibasic carboxylic acids containing the structural skeleton of diphenylolpropane. Consideration was given to the epoxy resin ester lacquer finishes, as compared with those of the special alkyds mentioned above.

This comparison served to establish that the films of these special alkyd resins are very close in their characteristics to those of the epoxy resin esters. In order to achieve resistance to alkalis, various physico-chemical conditions have to be taken into consideration, such as the dissociation constants of the dicarboxylic acids.

Lacquer Films Based on Epoxy Resins, Modified with Silicones

Paper read at European FATIPEC Congress, Lucerne.

Details were first given by A. Scartabelli, of the typical characteristics of the epoxy and of the silicone resin finishes. The production of a finish on the basis of silicone resin-modified epoxy resins was then considered. A detailed investigation was made of the characteristics of this type of lacquer finish material, in relationship to the baking conditions and the resistance to chemical agencies.

Various Characteristics of Oxide Coatings Produced on Aluminum by Anodizing

W. Geel and J. J. Schelen: Journ. Philips Res. Report (Holland), **12**, 240-243.

Details are given of measurements with respect to thickness, dielectric constant and density of the coating produced on aluminum by electrolytic oxidation. The structure of the anodized coatings was examined simultaneously by means of X-ray.

Two different values were found for the thickness of the oxide coatings:

13.7 and 12.7 Å/volt. The first value was measured after the test plate had been chemically cleaned, without removal of the air-oxide coating always present, since chemical cleaning apparently causes a surface increase of 7%. The value 12.7 Å/volt is the most probable. The density was 3.1 g./cc. and, for the dielectric constant, the value was 8.7.

If the oxide is formed at room temperature, it is completely amorphous, unless a Boehmite coating is first produced on the aluminum by boiling in water. In this case, γ^1 alumina is also formed. Oxidation at 100° C., apart from the amorphous oxide, always produces also the γ^1 alumina.

Electrolytic Separation of Titanium from Aqueous Solutions of Potassium-Titanium-Fluoride

By W. Machu: Paper read at the 2nd. Congress of the European Corrosion Federation, Frankfurt-on-Main, Germany, 1958.

Under certain conditions, it is possible to deposit titanium in the metallic form from potassium titanium fluoride solutions. The separation depends, above all, on the cathode material, and proceeds well on aluminum and antimony but not on platinum, copper, brass, nickel, iron, and zinc. The aluminum cathode is strongly attacked during the titanium deposition.

The titanium separation proceeds only within the pH range of 1.7 to 1.9, in the gray metallic form. Below a pH of 1.0, practically no titanium deposition occurs while, with pH values higher than 1.9, progressively more oxide and hydroxide are incorporated in the titanium deposit.

Comparative Field Tests on the Corrosion Resistance of Electroplated Zinc Coatings Passivated by Various Chemical Methods

Paper read at the 2nd. Congress of the European Corrosion Federation, Frankfurt on Main, Germany, 1958.

This paper gives the results of long-term field corrosion tests on passivated zinc coatings under various climatic conditions. Great differences with respect to the corrosion resistance exist between the coatings passivated in different baths. In most cases, a definite improvement in the corrosion resistance by the passivation treatment was established. Passivation baths were discussed, which particularly increase

the corrosion resistance of the zinc coatings. In general, it was established that only a very loose connection exists between the results of long-term field tests and rapid, short-term, laboratory corrosion tests. The results showed that with passivated zinc coatings, the greatest corrosion occurs in an industrial atmosphere and reduces in the series sequence—town, sea and country atmospheres.

It was noticed also that, on some chromated coatings, hardly any dirt or soot precipitated. Many of the passivated coatings retained their brilliance for a prolonged time, often up to the occurrence of corrosion of the basis metal. A comparison of the corrosion resistance of the zinc coatings passivated in the various baths, was given.

Structure and Characteristics of Electroplated Copper-Tin Alloys

F. Sauter: *Diss. Techn. Hochsch. Stuttgart, Germany.*

Deposits were obtained according to the method developed by the Tin Research Institute, from a bath of the approximate composition: 45 g./l. Sn; 15 g./l. Cu; 15 g./l. free KCN and 10 g./l. free NaOH. Operating temperature of the bath was 65° C. Anodes were of stainless steel, and fine silver wire, 0.5 mm. diameter, was used as the test cathode for the investigation, as silver permits a simple separation of the deposit for subsequent analysis. The cathode wires were 63.7 cm. long, and 1.5 cm. long pieces were cut-off of this for the fine-structure analysis by the Debye-Scherrer method.

With suitable concentrations of the bath, as well as by changing the current density, deposits of any desired composition could be obtained without difficulty. The alloy phases occurring in the deposited copper-tin alloys correspond to the constitutional diagrams of the recrystallized alloys, with the exception of the hexagonal ϵ -phase, whose existence was not observed with the electrodeposited alloys.

Tempering the electroplated alloys at 220° C., causes them to recrystallize very rapidly, and an alloy of 49% Cu and 51% Sn, after 10 minutes, showed the interference lines of the ϵ -phase on the Debye-Scherrer film.

The reflective capacity of the "speculum" deposits is lower than that of silver. With alloys between 30% and 50% tin, the deposits attain a micro-hardness of 500-540 kg./mm.² In this hardness range they are very brittle.

Improved Corrosion Protection by Yellow Chromating

G. Sschroeder: *CEIG Berichte (Duesseldorf)*, 3, # 4, 228-232.

From the author's own results and those obtained in other quarters, it was found that the yellow chromate treatment for zinc is clearly superior to other passivation processes, particularly the colorless ones. As a purely dip process, chromating is suitable for large-scale production. Various finishing problems had to be solved. With the short dip time of only 10-20 seconds, it is not always easy to achieve a uniform coating on mass ware, particularly with flat pressed and stamped parts and blanks. The chromate coating is very soft in the moist condition and easily damaged. Drying, therefore, must be conducted very carefully and the air temperature should not rise above 60° C.

As the chromating baths work at a low pH value, some zinc is removed from the surface. The total coating thickness of the zinc is chosen so that this zinc removal does not exceed 5-10% of the coating.

The dry chromate coating adheres well on the zinc surface. It is not to be expected however, that the coating will remain undamaged, if it comes in contact with a sharp-edged tool. Although the coating is harder than the zinc base, because of the small thickness of the chromate film, penetration into the softer zinc occurs. The mechanical characteristics of the zinc surface, thus, are only changed slightly.

As a result of the comprehensive investigations undertaken since the introduction of the yellow chromating, it has been possible to improve considerably the corrosion protection of functionally important equipment parts and to employ this equipment under climatic conditions of a severity, where formerly only a quite limited service life was reckoned on. This increased corrosion protection is obtained by relatively simple means.

Production of Fine Wire from Non-Ferrous Metals by Electro-polishing Procedures

Drant (Germany), 8 # 11, 486.

A continuous electropolishing procedure has been developed to produce small diameter wires. Constantan and nickel-chrome alloy wires are produced by drawing processes, but wire with a diameter thinner than 0.007

mm. is prepared best by the continuous electropolishing process. The cross-section remains constant after the electrolytic reduction in this manner if the wire is passed through the electropolishing bath at a uniform speed and at a constant current density and voltage. The best results have been obtained with the following electropolishing bath:

Phosphoric acid (85%)	125 cc.
Water	30 "
Ethyl alcohol	10 "
Citric acid	50 g.

For example, by electropolishing, a wire of 0.0038 mm. diameter is produced from hard-drawn stainless steel wire of 0.01 mm. diameter. The smallest diameter obtained was 0.0033 mm. The possibility exists, however, of producing still thinner wire, with refinement of the equipment used. The smallest wire diameter produced from non-ferrous metals by drawing is to 0.0063 mm. This wire is finish-drawn at a speed of about 2 meters/second. Still smaller wire diameters than this can be drawn practically by the electropolishing process.

Structure of Anodized Aluminum Oxide Coatings

M. Paganelli: *Aluminio (Italy)*, 27, #1, 3-12.

An oxide coating obtained by anodizing aluminum was examined with an electron microscope by the author, using three different test methods. On the basis of the results obtained, it was possible to confirm the soundness of the structural hypothesis of Keller, Hunter and Robinson, according to which the porous anodic oxide coating embodies a cellular structure.

Recent Developments in Anodizing Techniques

F. Flusin: *Aluminio (Italy)*, 27, #1, 13-18.

New developments are considered for the mass anodizing of small component parts with respect to the anodizing equipment, and processing methods which, perhaps, can also be applied to large-size parts in the near future.

When anodizing porous cast parts, rejects can be reduced or eliminated by previously impregnating the pores with a suitable fluid plastic. The author then discusses the results that have been obtained with bronze-colored building units of anodized aluminum, which have been exposed to industrial atmospheres.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



Anti-Rust Paints

Finishes Div., E. I. Du Pont de Nemours & Co., Dept. MF, Wilmington, Del.

Meeting a demand for simplified procedures in painting metal to stop rusting as well as to beautify, the above manufacturer has developed five new products suited for any metal finishing job. Three of the anti-rust paints are primers. One of these is a specially formulated version of the time-tried red lead primer for iron, steel or tin surfaces that cannot be cleaned to bright metal. Its blend of resin and oils penetrates rust to insure good adhesion to metal.

A second primer is a zinc chromate formulation, ideal for iron and steel, tin, and aluminum which is free from rust. It is excellent for touch-up and can serve as a satisfactory all-purpose interior and exterior primer.

The third is a new type of primer designed for use over new or non-rusted galvanized metal and copper. Drying in 30 minutes, this galvanized metal primer thins with water.

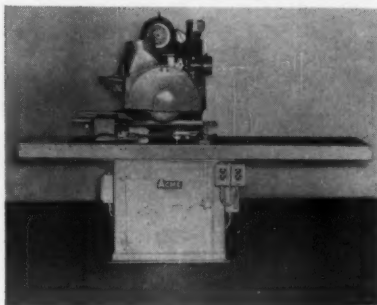
Wrought iron black, which produces a low sheen, jet black finish, and chrome finish aluminum for an extra brilliant chrome-type finish round out the new line.

All the metal primers are engineered for topcoating with "Duco" enamel colors.

Automatic Polisher

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Road, Detroit 20, Mich.

A new automatic polishing and buffing machine that finishes round, square, hexagonal or octagonal tubular metal parts consists of a motorized head, reciprocating work table, and a cam operated index mechanism for a group of mandrel assemblies mounted on the table. The machine can be made as either a unit or one having separate reciprocating table and adjustable head units. Standard models of the machine have a maximum table travel of 48-inches. Parts up to 42-in. long can be handled.



To operate the machine, the parts are loaded over mandrels. Ease of loading is provided by a pivoted mandrel mounting. With the work loaded into position, the mandrels lower to work position and are reciprocated under the buffing wheel. At the end of each reciprocation the mandrels index automatically to present another part surface for finishing. Up to eight mandrels can be mounted on the reciprocating table, depending upon the diameter of the work to be finished.

The machine occupies a floor space (including table clearance allowance) of about 9-ft. by 4-ft. It is approximately 6-ft. high overall.

Batch Washer

Alvey-Ferguson Co., Dept. MF, 5999 Disney St., Cincinnati 9, Ohio.

Designed for batch cleaning of a wide variety of metal parts and assem-



blies, a new, agitating dip type washing machine named the A-F "Surg-A-Flow" has a work tray operated by a large capacity air cylinder, with one simple control. It is a single moving assembly. No motor is required. No electrical connections needed, except when the solution tank is heated electrically.

This relatively small, relatively low-priced, thoroughly job-tested machine, eliminates conveying of parts to a centralized cleaning area and allows immediate routing of cleaned parts to assembly areas or storage. A battery of machines will permit multiple stage operations involving washing, rinsing or dunking in oil.

Occupying only 2'-6" by 3'-4" of floor space, and with a loading height of 37", this machine, ruggedly constructed for long, maintenance-free operation, can be furnished unheated or heated by means of steam, gas or electricity. Accessory equipment also available.

Plating Cylinder

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

The new Mercil Model 59 plating barrel cylinder is a 14" x 30" or 14" x 36" O.D. or I.D. Plexiglas unit. The motor is mounted right on the shaft, which runs through the center of the motor. The motor is centrally located between the cylinder heads to provide proper balance and permit ease of handling. Because of this type construction, the overall height of the unit is only 2" higher than the standard unit and the equipment can be used under low head room conditions.

Any standard Mercil belt drive cylinder can be converted to this type unit by simply adding the motor drive and converting the angle iron hanger tie rod.

The forward-off-reverse switch is mounted directly on the angle iron hanger in a convenient location at the end of the angle. Wiring is contained in watertight, seal-tight flexible tubing. The motor is a totally enclosed, ball

LEA

ABRASIVE FINISHING METHODS

NICKEL and NICKEL ALLOYS

STAMPINGS • CASTINGS • FORGINGS • FORMINGS • DIE CASTINGS

Pure nickel and the high nickel alloys may be finished to any of the mechanically produced effects obtainable on white metal, ranging from a sand blast finish to the high lustrous mirror finish. A satin finish can be produced with fewer operations and very much less time than is required for a high lustre polish. No short cuts for developing a desired effect are possible. A "base" from which all surface defects have been removed must be produced and on this the finish is developed. The coarser the abrasive required to produce this "base", the more operations required to produce the desired finish. Each subsequent operation must remove the wheel marks produced by the preceding operation.

Nickel Silver, because of the quantity used in the metal industry, must be considered as one of the most important of the nickel alloys. However, because of its high copper content and tendency to tarnish, it is seldom used by itself but generally as a base metal for subsequent electrodeposits. It is much easier to machine and abrade than harder nickel alloys and responds more readily than the higher nickel alloys to cut-down buffing.

Nickel is one of the most important metals applied by electrodeposition and the finishing of nickel plate will be covered separately.

POLISHING... Recommended polishing speeds for nickel alloys are about 6500 to 7500 sfm. Recommended wheels are sewed buffs, felt, canvas and leather polishing wheels, coated with **Leabrament** or **Plasti-Brade** (liquid abrasive compositions). If loose abrasives are used for preparing polishing wheels, **Gripmaster** or **Plasti-Glue** polishing wheel cements should be used.

INTERMEDIATE FLEXIBLE POLISHING... To remove small defects, flash, etc. and produce a uniform finish, use **Grade "C"** or **Grade "N"** **Lea Compound** on sewed buffs at 6000 sfm. A special application of this is in the edging of nickel silver flatware immediately after trimming. For this, **Grade "C"** **Lea Compound** is used on an 8" diameter, 6" face packed muslin buff at 2400 rpm.

SATIN FINISHING... For the production of a satin finish, **Grade "N"** **Lea Compound** is recommended on a high count full-disc muslin buff at 5500 sfm. Finer and coarser grades of **Lea Compound** are available.

BRIGHT FINISHING—Bar Compositions... To prepare the surface of nickel silver for plating, it is generally given a cut-down buffing operation with a Tripoli composition such as **Grade 765 Learok** on a pocketed or ventilated buff at about 8000 sfm.

To produce a bright finish on high nickel alloy base metals, the following procedure has been used to advantage: cut-down buffing with **Grade 316 Learok** on a loose muslin buff at 7500 sfm; then color buff on the same type of wheel and at the same speed using **Grade 302-C Learok**.

BRIGHT FINISHING—Liquid Compositions... For cutting down operations use **Grade TH52P Liquabrade**. For coloring operations use **Grade UF47J Liquabrade**. For high coloring use **Grade UH20A Liquabrade**. Buffs and speeds for use with **Liquabrade** are the same as for Bar Compositions.

BUTLER FINISHING... Butler Finishing is carried out after bright finishing with **Grade "B-12"** and **Grade "MH"** **Lea Compound** at about 5000 sfm.



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Quality Products

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Lea-Michigan, Inc., 14459 Wildemere Ave., Detroit 38, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

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ABRASIVE FINISHING
NICKEL and NICKEL ALLOYS

Tailored cyanide copper processes



*...there's a specific
Lea-Ronal
copper process to meet
your own
exacting requirements*

Over the years Lea-Ronal has gained world-wide recognition for its research on cyanide copper plating. From this research and development have come numerous processes, each with its own characteristics that make it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Cyanide Copper Processes has been thoroughly production-tested and has been instrumental in improving the quality and production of the user's plating operation.

Any order for a Lea-Ronal Process carries with it plus values in experienced technical service and know-how.



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for bright
high speed
copper

COPPER-GLO

For plating buffed zinc die castings or steel where maximum leveling or hiding is not a factor.

A full bright high speed cyanide copper that has become the industry standard. Through continued research this process has been constantly improved to give trouble free bright high speed operation.

for
buffable
copper

CUPRALL

A lustrous, ductile, buffable copper than can be plated at high speeds. Because of these characteristics and its exceptional tolerance to impurities, this bath has become the standard for such operations as bumper refinishing.

for
hiding
imperfections

Q-STRIKE

A cyanide copper strike developed to aid in "hiding" surface imperfections that are not covered by conventional strikes or bright copper processes. Will increase hiding and leveling when used as a strike prior to bright nickel.

for micro-
leveling and
lustre

Q-LEVEL

A new improved economical and simple cyanide copper process that offers a definite degree of leveling or hiding without employing current reversal cycles. Imperfections in castings can be partially or completely hidden (Leveling is achieved on surface roughness not exceeding 10 RMS).

for
high rates
of deposition
plus micro-
leveling

AIR-Q-LEVEL

A Q-Level Bath specifically designed for air agitation. Offers all the advantages of the Q-Level Process plus increased rates of deposition, and excellent metal distribution.

for leveling
plus high rates
of deposition

PR-Q-LEVEL

A Q-Level Bath designed to operate with Periodic Reverse. In addition to the high rates of deposition, macro-leveling as well as micro-leveling can be achieved. Process is simple, economical, completely stable with no deterioration of brighteners over prolonged operating periods.

WRITE OR PHONE:

THE LEA MANUFACTURING CO. 16 CHERRY AVE., WATERBURY 20, CONN.
THROUGH WHOM THESE CYANIDE COPPER PROCESSES ARE EXCLUSIVELY MARKETING.

Note: The above Lea-Ronal Cyanide Copper Processes are covered by patents or pending patents.

Are you interested in Buffing, Polishing and Burring Specialties? SEE OTHER SIDE OF THIS INSERT.

bearing type available in 220 and 440 volts.

Alkaline Derusting Process

Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.

The Endox process, a patented, alkaline method for derusting and descaling of steel and activating it for plating, removes rust, scale, carbon smut, oxides and light soil from iron and steel alloys by electrolytic treatment in an alkaline solution at room temperature.

Acid pickling with its accompanying attack of the work and surrounding equipment and its production of carbon smut on the steel surface is eliminated. Acid dips in plating lines are also eliminated by the deoxidizing and activating ability of the process. Complete preparation of steel for plating in one simple step is possible.

Either of two new products, 209 or 214, can be used to make up the processing solution. Both are completely prepared, powdered materials which need only be dissolved in cold water at concentrations of from 1 to 3 lbs./gal. to make up the bath. No other salts are required. #209 is superior for scale removal while #214 is preferable where heavy rust is present. Electrolytic treatment with either direct or periodic-reverse current can be employed.

The bath can be maintained indefinitely by periodic analysis and replenishment and by occasional removal of precipitated sludge. Since the bath is seldom dumped, it is very economical to operate.

Blast Cleaning Barrel

Pangborn Corp., Dept. MF, Hagerstown, Md.

The new 15-cu.-ft. Rotoblast barrel is designed to provide the first heavy-duty type barrel of medium size to clean large castings weighing up to 500 lb. each. It will handle a batch load of 2700 lbs.

Available with standard controls or in semi- or completely automated types, the unit incorporates a 30-hp wheel which delivers 50,000 lb. of abrasive per hour for rapid cleaning at low cost.

The blast cabinet is constructed of welded steel plates, completely sealed and dust tight. The jam-proof two-piece barrel door travels on rollers in labyrinth-sealed guides which contain no gaskets or rubber seals. The door

NEW *Hammond* "4-IN-1" FINISHER

Ideal for
**"All Around" GRINDING,
POLISHING, BUFFING AND
DEBURRING**



3-ROL Lathe
with
UP-2 Head

This new combination offers contact wheel, free belt, platen grinding, polishing and deburring plus buffing. A modern versatile machine for your tool room, machine shop, polishing, fabrication and assembly departments. Soon pays for itself by producing a better finish and speeding up operations now done on obsolete machines, grinding wheels or files. Write for catalog.



OVER 17,000 *Hammond*
ABRASIVE BELT GRINDERS
NOW IN SERVICE

Hammond Machinery Builders INC

1601 DOUGLAS AVENUE

KALAMAZOO, MICHIGAN

and guides are wider than the barrel opening: this eliminates damage to the guides during loading and prevents abrasive from entering the labyrinth seals. When closed, the door is abrasive and dust-tight.

The door guides above the top deck accommodate the open door in a vertical position, permitting easy access to the upper barrel deck where the abrasive separator is mounted.

Abrasive cleaning and recycling consists of four phases. First, the abrasive is coarse screened in the bottom of the cabinet hopper. Secondly, the abrasive is passed by screw conveyor into a patented 16-in. scalping drum where all coarse particles larger than abrasive size are removed and ejected

into floor-level containers. The perforated scalping drum is longitudinally louvered to positively prevent the passage of all foreign materials such as nails, wire, rod segments etc. Third, a newly-designed bucket-type elevator then lifts and deposits the sand and abrasive mixture into a 75,000-lb.-per-hour capacity air-wash separator where all sand and fine particles of abrasives are removed. Fourth, as an extra precaution all air washed abrasive is then passed through final screening. The clean, usable abrasive is then passed to a storage hopper for re-use. Offered as optional equipment is a special 150,000-pph separator for use where extremely heavy sand loads are prevalent.

Metal Cleaners

E. F. Houghton & Co., Dept. MF,
303 W. Lehigh Ave., Philadelphia 33,
Pa.

A new series of four cleaning compounds for production line cleaning of metal parts is now available.

Cerfa-Kleen HPW (hot power washer) is a heavy duty cleaning compound with no free caustic, reported as non-foaming, non-caking, with rust preventive added.

Cerfa-Kleen CPW (cold power washer) is a formulation of mild, fast-dissolving alkalies usable at room temperature. Non-foaming, non-caking, non-dusting, without free caustic, it contains rust preventive and water softener.

Cerfa-Kleen HST (hot soak tank) is a high detergency compound for fast immersion cleaning in hard water. Non-caking, non-dusting, it has no free caustic.

Cerfa-Kleen CST (cold soak tank) is a concentrated liquid to replace toxic or flammable solvents. It has no free caustic, and is also usable for "wipe-off", tumbling and other mechanical cleaning operations.

Ultrasonic Degreaser

Branson Ultrasonic Corp., Dept. MF, 40 Brown House Road, Stamford, Conn.

The Model AC-25 Sonogen is a new self-contained ultrasonic degreaser in a compact, stainless steel cabinet. After immersion in the ultrasonic degreasing tank, work is spray-rinsed by hand, placed in the vapor zone, then removed from the unit spotlessly clean and dry.

Measuring just 44" x 18" x 36", unit can be easily installed in any shop or plant. It does not use separate generators, cleaning chambers, or rinsing tanks. Only water and 110-v, 60-cycle electrical connections are needed.

As a guard against corrosion, all de-

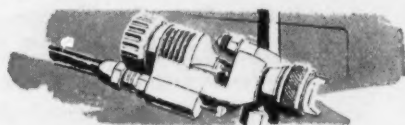


greaser parts in contact with solvent are made of stainless steel or TFE plastic.

The degreaser has five main components: a 10x8x8-in. deep ultrasonic cleaning tank; a boiling sump; an ultrasonic generator producing 40,000 cps; transducers (in the cleaning tank) that convert the electrical energy into mechanical vibrations; and a system to recirculate filtered solvent.

A variety of fail-safe features protect the unit. A water cooling system limits evaporation loss, and an automatic interlock shuts off the sump's strip heaters if the cooling system fails. Absence of liquid in the cleaning tank stops the ultrasonic generator to keep the transducers from overheating.

The one sure way of getting the
your products



that offers the entire package:

for equipment (2) an unbiased

the method best suited to your

research, engineering,



Three words say it:

DeVilbiss total

Spray guns Automatic spray coaters Dip & flow
coaters Hot-spray systems Airless spray equipment
Portable spray outfits Air compressors Hose &
connections Paint tanks & pumps Circulating
systems Spray booths Paint baking ovens Make-up
air systems Power spray washers Rustproofing


To protect the operator against high voltage, another interlock shuts off power when the cabinet access door is open.

Entrapped Salts Remover

Heatbath Corp., Dept. MF, Springfield 1, Mass.

"No Bleed" is a liquid product used for removing entrapped salts from electroplated powdered metal parts, eliminating the bleeding or staining condition that is usually associated with these parts.

The solutions are operated at 250°-275° F.; the parts to be treated are immersed for 2-5 minutes or until all visible gassing action ceases. The parts

most satisfactory finishes for
is to consult the only company
(1) one-source responsibility
recommendation  on
requirements (3) all services--
training--to insure job success.

service *Put it to work for you now!*

machines Pickling equipment Dust collectors Oven
heaters Engineered finishing systems Customer
research laboratories World-wide parts & repair
service Complete operator training • THE DEVILBISS
COMPANY, TOLEDO 1, OHIO. ALSO BARRIE, ONTARIO; LONDON,
ENGLAND; SÃO PAULO, BRAZIL. OFFICES IN PRINCIPAL CITIES.



are then removed and allowed to cool. Degreasing solvents are used to remove the material remaining on the parts. If the plated parts were not post treated prior to treatment they can, in many cases, be post treated after. The product will not remove stains or bleeding salt deposits once they appear; therefore, it must be used on freshly plated parts.

Rust Preventives

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

Composition 15 is a new rust preventive liquid to be added to either hot or cold water rinses to prevent rusting of cast and malleable irons, sintered metals, and steel during process-

ing. It is especially adapted to porous metals which, in most cases, will rust immediately after rinsing, especially after pickling operations. Because there is no residue left on the surface of the metal, organic coatings can be applied to the surface without any further treatment or without any detrimental effect on the adhesion of the coating. It is used from one to four fluid ounces per gallon of water.

Composition DR is a new rust preventive to be added to hot or cold water rinses to facilitate drying and add corrosion resistance to the steel surface. This product is claimed to give extended corrosion resistance over previous products of this type. It is also designed to be used in tumbling

barrel rinses to facilitate drying, eliminate staining, and add corrosion resistance to the steel surfaces. There is also a Composition D.S. available for power washers.

Plastic Gate Valve

Vanton Pump & Equip. Corp., Dept. MF, Hillside, N. J.

The throttlable Penton valves, which do not lose tensile strength or hardness, and which are not subject to elongation at elevated temperatures (100-125° C.) are generally resistant to all inorganic acids except fuming nitric and fuming sulfuric. These valves are particularly suited for use in process operations that require continuous exposure to corrosive media at elevated temperatures.

The valve offers the combined features of straight-through, no-pressure-drop flow, with close throttling control which makes it one of the most versatile available.

The plastic gate valves of "Penton" are available in sizes from 1/2"-2" with socket weld, flanged or screwed ends.

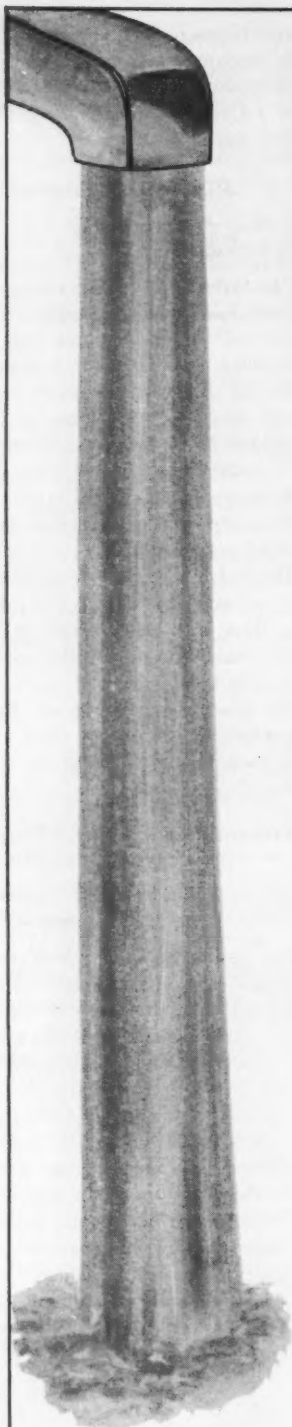
Freon-Sonic Energy Cleaning System

Bendix Aviation Corp., Pioneer-Central Div., Dept. MF, Davenport, Iowa.

For applications in which residual molecular film characteristic of chlorinated solvents, or where contact with water cannot be tolerated, the new system offers particular quality and cost-saving benefits, it is claimed. Its use is especially recommended for cleaning parts made from or containing beryllium, for ultra-precise electronic components, or for other parts or assemblies, which are incompatible with aqueous solutions, but require absolute elimination of contaminants.

The system can be secured with up





NOW

**Get a Spot-free Rinse
Without Buffing Use**

DISTILLED QUALITY WATER

**from Portable
Demineralizers
on a Rental Basis**

Maintain the highest quality final rinse water by recirculation through our units. Eliminate all hand polishing and buffing caused by water spots. Save water. Use also to make up plating baths.

- Available on a rental basis
- Maintained and serviced by Culligan experts
- Up to 40 gallons per minute
- No elaborate installation
- Can be located at point of use
- Eliminates the bottle problem
- Dependable, uniform quality
- Meets government specifications
- For large or small uses.

How Much Does It Cost?

Surprisingly little, since the same water is used over and over again.

Write today for Culligan's new "DI Water" Bulletin and the name of the Culligan dealer nearest you prepared to furnish this new special service.

Culligan

**DI WATER DEPARTMENT
NORTHBROOK 6, ILLINOIS**

to four or more cleaning stages: a Freon distillate flush, sonic energy clean, sonic energy rinse and Freon vapor rinse. Parts to be cleaned are first flushed with a portable lance which is fed through a filter from the distillate reservoir. The parts are then processed in sequence through sonic energy cleaning and rinsing and are placed in suspension over the distilling chamber for the vapor rinse cycle. Drying occurs almost instantaneously as the basket is raised above the vapor level.

The system is designed to provide an extremely high level of solvent purity. Vapor from the distilling chamber is condensed on water jacketed side walls of the cleaning compartment, and flows into the reservoir. It then cascades successively from the reservoir to the sonic energy cleaning chamber to the sonic energy rinse to the solvent boiling chamber.

Other important design features include filtration through 2-stage filtering units which remove solid contaminants down to one micron.

The complete system is housed in a stainless steel cabinet and is available in three different sizes, offering cleaning chambers, respectively of 9" x 14", 14" x 20" and 18" x 25" dimensions. Sonic energy is provided by special design magnetostrictive transducers, which have inherent characteristics of producing highly reliable and efficient cleaning power under sustained production conditions.

Vibratory Finisher

Roto-Finish Co., Dept. MF, Kalamazoo, Mich.



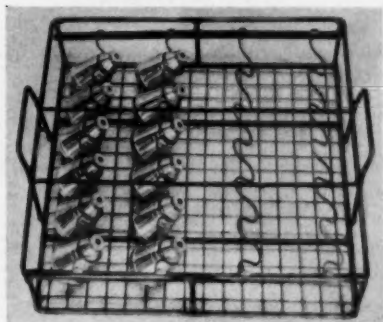
A new, improved model of the Vibratron, is stated to eliminate the need for manual loading and unloading of parts and media. A built-in, removable, double-decked vibrating separator in the base of the machine

separates parts and media, as well as fragments from the media, in one simple operation.

The machine can be hopper-fed, and the new design permits discharge of finished parts onto a conveyor where they move on to the next operation.

Wire Racks

Wiretex Mfg. Co., Inc., Dept. MF,
40 Mason St., Bridgeport, Conn.



Specially fitted racks, designed to protect close tolerance, thin-walled small metal units during degreasing and work transfer are available in a variety of sizes. The racks are fitted with wire holders, shaped to hold the product securely and to keep them from touching each other or any part of the basket. Holders are constructed to meet individual product specifications and are replaceable.

The racks, 16 x 16 x 3 1/2", have a steel frame and carrying handles and a mesh floor. Mesh is available in any standard specifications. Racks are designed for stacking in a minimum of space.

Plastic Blowers

Milo Mfg. Co., Dept. MF, 404 No.
Broad St., Elizabeth, N. J.

A new improved series of PVC blowers features aero-dynamically perfect, injection molded fan wheels made of low pressure polyethylene. These wheels guarantee a maximum degree of efficiency and a long life due to the unbreakable material. The blower cases are made of pressed PVC and the cover plates fastened by stainless steel screws and nuts. The larger sizes have welded wheels made of low pressure polyethylene.

All blowers are equipped with iron pedestals and motors. The smaller sizes are directly connected with integral motors, while the larger sizes are equipped with driving belts. They are also available without motors, and may be mounted in any of 8 positions.

NEW EXCLUSIVE!

ATLANTIC GREASELESS COMPOUNDS

WITH **K-134**

The miracle additive newly discovered and developed by Atlantic's research laboratories



- REDUCES APPLICATION TIME
- ADHERES BETTER TO BUFFING WHEELS
- CUTS DOWN COSTLY WASTE
- ASSURES UNIFORM SATIN FINISH

Order NEW Atlantic Greaseless Compounds with Additive K-134 for faster, more economical buffing and polishing; and for longer-lasting, higher quality finish of metals, plastics and wood.

Devoted exclusively to producing unexcelled greaseless compounds, Atlantic maintains constant research to continually improve its products. The dependable uniformity of Atlantic compounds is assured by the highest grade ingredients and efficient quality control. Technical assistance and data available on request.

 **THE ATLANTIC COMPOUND CO.**

6 CHARLES ST., CHELSEA 50, MASS.

there is a

STEVENS LIQUID TRIPOLI

for every buffing job!

HERE ARE THREE LEADERS:

27-L

COLORING COMPOSITION

A superior buffing compound for aluminum or any non-ferrous metal requiring extremely high color. Consistent, economical performance lowers costs, reduces rejects.

44-L

FASTEST-CUTTING TRIPOLI

Emulsion-type compound that sets record for pieces buffed per cwt. on all non-ferrous die castings, brass and aluminum.

59-L

ALL PURPOSE CUT AND COLOR TRIPOLI

Combines fast cutting characteristics with fine coloring qualities on all non-ferrous metals. Offers top total economy on the job.

Write for your copy of Stevens' new folder on liquid buffing and coloring compositions!



FREDERIC B.

STEVENS

INCORPORATED

DETROIT 16, MICHIGAN

Airless Spray Unit

Spee-Flo Co., Dept. MF, 6614 Harrisburg Blvd., Houston 11, Tex.



Development of the H-Gun (Pat. Pend.) and improvements in the HydraAirless 20 is claimed to make possible the handling of any type material with 40 to 100% increase in efficiency. Flooding and pig-tailing, which are two common problems of airless spraying, have been totally eliminated. Fluid pressure needed for proper atomization has been reduced by 40 to 50%. Spray patterns are equal to the finest produced by air atomization. Edges of the spray pattern are properly feathered to permit overlap without danger of runs or sags. Materials which formerly required heat to be sprayed by the airless method, can now be sprayed cold with perfect results. Materials that could not be sprayed at all by the airless method because of quality control, can now be sprayed with the heated unit, it is stated.

Water Demineralizer

Cochrane Corp., Dept. MF, 17th St., below Allegheny Ave., Philadelphia 32, Penna.

A new packaged demineralizer has been designed for quick installation. On-site erection consists of setting the unit in place and connecting to air and raw water supply, treated water outlet, and open drain. Only electrical connection required is for a conductivity controller, which uses 110 v, 60 cycle current from a standard lighting outlet.

Designated as the Uni-Pac "M" series, models of the new demineralizer are available in capacities from 2100 to 13,200 gph using raw water with 10 grains per gallon total exchangeable anions.

Operating valves and piping are cor-

are lined with the same material. Auxiliary polyethylene regenerant tanks rosin-proof PVC and exchange tanks are provided for acid and alkali.

Units are equipped with conductivity and rate-of-flow indicators. Optional controls include totalizing water meter, audible alarm, and automatic cut-off valve to stop flow at end of service cycle.

Centrifugal Pump

Sethco Mfg. Corp., Dept. MF, 2284 Babylon Turnpike, Merrick, N. Y.

A new type of centrifugal pump, specifically designed for transferring corrosive liquids and solvents without leakage, called El-10, features a pump which is inside the motor housing and is magnetically driven by the motor.

Stuffing boxes, mechanical seals, shaft wear, coupling and alignment



problems are eliminated, resulting in leakproof and maintenance-free operation. Motor rotor and stator are isolated from the pumping chamber by being canned in stainless steel 316. Rotor bearing is graphite; gaskets are teflon.

Maximum flow with water is 20 gallons per minute. Maximum head developed is 25 feet. Liquids can be handled up to specific gravities of 1.5. Maximum working pressure is 150 psi. Inlet and outlet pipe connections are equipped with stainless steel 316 hose adapters for 1/2" ID hose. Hose adapters for 3/4" ID and 1" ID hose are also available.

Mounted in vertical position on 3 stainless steel legs, the pump is furnished with a stainless steel carrying bracket with rubber handle for easy portability.

The $\frac{1}{8}$ HP, 3400 RPM, 115 volt, 50/60 cycle, 1 phase, totally enclosed motor is equipped with 3 wire grounding cord, feed thru switch, grounding plug and adapter for 2 wire outlets, as well as a combination hot wire start and overload relay. Standard motors are furnished with Class A motor insulation suitable for fluid temperatures to 210° F. Class H motor insulation is available for fluid temperatures to 350° F.

The 15 feet of hose furnished is pure gum chemical for both acid and alkaline solutions; polyvinyl alcohol hose is available for solvents.

Hose clamps are stainless steel; strainer is furnished for suction end of the hose.

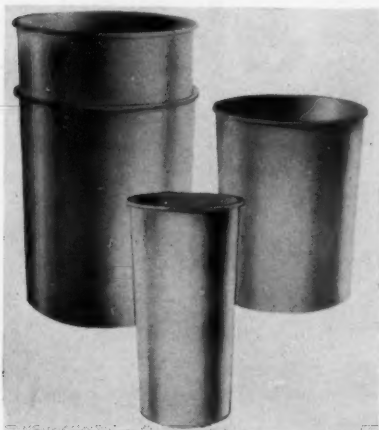
Overall dimensions are 17" high x 6 $\frac{1}{2}$ " motor diameter. Weight is 25 lbs.

Polyethylene Drums

Redmanson Corp., Dept. MF, York, Pa.

Development of a large size, molded polyethylene drum has been announced by the above manufacturer. These drums have characteristics which make them applicable for electroplating operations, being extremely resistant to corrosion, which usually takes place in containers used to handle and store acids. Because of injection molding, the walls are uniform in thickness; there are no weak spots, no pinholes.

The polyethylene container is light in weight and easy to handle. It may be easily cleaned and tightly sealed. These drums may be nested inside one



another when they are empty, thereby reducing storage space requirements. They are produced in various sizes up to 55-gallon capacity.

RANSBURG

What Would Paint Savings Like This* Mean in YOUR Finishing Department?

Quality is all important in the production of fine Metalcraft furniture by George Koch Sons, Inc., Evansville, Indiana.

That's why they use the Ransburg Electrostatic Hand Gun to apply a uniform clear coating on their brass-plated furniture. The protective coating is baked on. Although the bulk of their present production is in the popular brass line, they still paint the metal furniture in a variety of colors with the Hand Gun.



Painting is **CLEANER**
... **QUICKER** ... **CHEAPER**
with the Ransburg Electrostatic
Hand Gun.

These chairs and table
are typical of the Koch
line of metal furniture.



*10 GALLONS OF PAINT NOW DOES THE JOB WHICH FORMERLY TOOK 30 GALLONS

On one item—a TV table—they formerly used 30 gallons of enamel to coat 1000 units by combination dip and air spray method. Now—with the Ransburg Electrostatic Hand Gun, they paint 1000 tables with only 10 gallons. And, they get a better, more uniform coating, too.

NO REASON WHY YOU CAN'T DO IT, TOO!

See how the Electrostatic Hand Gun can save time ... paint ... and cut costs in **YOUR** finishing department. Or, if your production justifies, it'll pay you to investigate Ransburg's automatic electrostatic spray painting equipment. Write for our No. 2 Process brochures which show numerous examples of modern production painting in both large and small plants.

RANSBURG

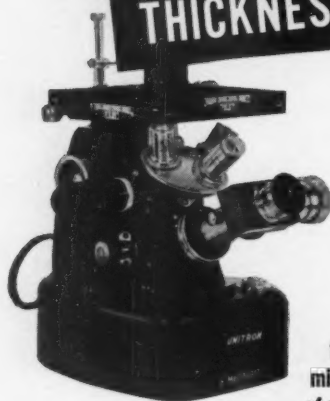
RANSBURG

Electro-Coating Corp.

Box-23122, Indianapolis 23, Indiana

WHY GUESS ?

MEASURE PLATING THICKNESS

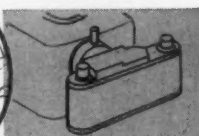


to a
millionth
of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to measure and be sure?

UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metalurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done — by requesting a **FREE 10 DAY TRIAL** in your own plant. There is no cost and no obligation.



Above: Accessory camera attachment.
Left: Observing the plated deposit.

\$468 Model PL-MEC complete with all optics and standard accessories

As above with built-in camera attachment, but without 35mm. camera back: **\$540**

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
204-206 MILK STREET, BOSTON 9, MASS.

Please rush UNITRON's Microscope Catalog 13-Z

Name _____
Company _____
Address _____
City _____ State _____

Organic Finish

Industrial Finishes Co., Inc., Dept. MF, 1119 Land Title Bldg., Broad and Chestnut Sts., Philadelphia 10, Pa.

A new protective and decorative coating for metals which eliminates the necessity for baking, Ep-Ack is an epoxy acrylic and comes in a wide range of attractive colors, in any degree of gloss from zero to 95.

One of the most important claims for this new product is the fact that it dries in a few minutes. The material is a blocked acrylic with a new plasticizer, making possible excellent flexibility. Its outdoor potential is excellent, and it resists many elements injurious to metals — salt fog, humidity, acid and alkalies.

Inflated Sanding Drum

Nu-Matic Grinders Inc., Dept. MF, 8224 Carnegie Ave., Cleveland 3, Ohio.

A new inflated sanding drum for use with coated abrasive bands, Model 890 Valcore, is designed for application on floor-mounted machinery. The new drum is 8" in diameter and takes a 9" wide abrasive band. It is built like a low pressure tubeless tire, a design which has been proved-in-use on other inflated wheels in the series.

Resilience of the air-inflated rubber contact drum allows the abrasive to follow contours and present more abrasive to the work. No part of the core or side plates extends above the abrasive, providing an unrestricted working area across the entire abrasive surface.

The new drum is leak-proof, constructed to rigid safety specifications and requires no adhesive or sealant to fasten the drum to the core. All parts are replaceable, including the contact drum. Standard bore size is 1 1/4", with larger sizes available.

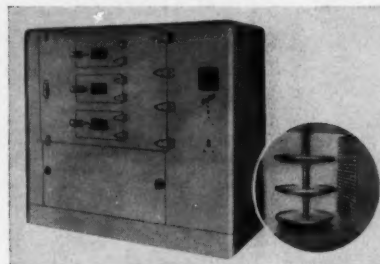
Three types of spindle stands may be used for driving the drum. These are



the standard floor-mounted, adjustable and variable speed models. They may be equipped with single or double spindles. Operating speed is 1800 rpm, with 1200 rpm machines also available.

Rotary Shelf Oven

Despatch Oven Co., Dept. MF, 619-8th St. S.E., Minneapolis, 14, Minn.



Laboratory or production workers requiring extra precision control of heat uniformity will appreciate this new rotary shelf laboratory oven. The rotary shelves, either manually or mechanically operated, are spaced on 12 inch vertical centers. The maker recommends manual operation for temperatures below 300°F. For higher temperatures to the oven maximum of 850°F., there is a motor and reduction gear provided to maintain constant shelf rotation.

The rotary shelf oven comes in all sizes of the "V" oven series. This series can be supplied for gas, electric or steam heat. It utilizes forced convection with horizontal air flow. Even without the rotary shelf this model maintains heat uniformity within $\pm 1^\circ\text{C}$. throughout the work chamber. The addition of the rotary shelf is said to give identical heat to every product placed on the shelves.

Other features of this series include hinged plug-type doors located within one main door on same level as rotary shelf for easy removal of product. Each door is provided with heat resistant glass window.

Rust-Inhibiting Paint Primer

Jet-Dri Div., Consolidated Chem. & Paint Mfg. Co., Inc., Dept. MF, 456 Driggs Ave., Brooklyn, N. Y.

A new fast-drying rust inhibiting primer is claimed to stop rust on contact with a special pigment that reverses normal electrogalvanic action. Described as the fastest drying rust inhibitor ever developed, the new paint dries to a hard, impact resistant coat in fifteen minutes.

Jet-Dri prevents rust by forming an air-tight, protective bond to metal surfaces. Its specially formulated pigment, named CCP-17, reverses normal electrogalvanic action that slowly oxidizes iron and steel when in contact with air.

The paint's fast-drying resin base produces a tough, impact resistant coat which is far more impervious to blows, scratches and abrasion than ordinary rust preventives.

It is stated that the rust inhibitor is unusually resistant to acid, alkali, salt spray, corrosive fumes, oil and boiling water. It dries to a hard, attractive salmon-colored coat. Easy to cover with standard finishes, the primer may be covered by a single coat of most finishing paints, including pastels.

Easily applied by brush, roller, spray or by dip, the primer adheres well to cold rolled, smooth and highly polished steel. When applied to rusted surfaces, from which loose rust scale has been removed, the primer forms a lasting, impact-resistant bond by penetrating through to the basis metal.

Wet Blast Unit

Pressure Blast Mfg. Co., Dept. MF, Manchester, Conn.

A new wet blast unit, capable of operation from a "sitting-down" position, the Consol-Matic was specially designed for the high production rate finishing of small parts, operations normally handled by women.

Two bays are provided at the operating station where work is loaded and unloaded. Moving blast guns, driven by air cylinders, are positioned at each



bay. In operation, the operator places parts in either or both bays and depresses the foot lever. This begins movement and activation of the blast guns. A pre-set timer determines the length of blast time as well as the speed of gun oscillation.

The design of the bays or parts allows for the use of masks if decorative effects are to be achieved. Positioning

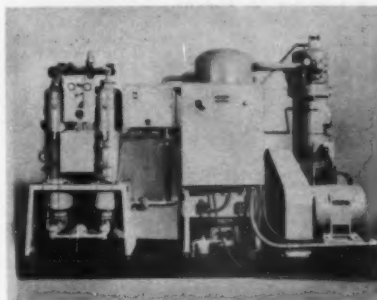
devices are provided and guns are individually movable, which adds to the flexibility of the unit.

The unit operates on the aspiration system, which eliminates the need for a pumping mechanism in the blast circuit. Employing fine abrasives (up to 5000 mesh), the unit imparts fine, satin, chemically clean surfaces without heavy etching, stock removal or distortion.

Dimensions are 46" high, 24" wide, and 34" deep. Construction is of 14 gauge stainless steel. Weight is only 130 lbs. which allows installation on upper floors of buildings where stress is a factor.

Air Dryer

Trinity Equip. Corp., Dept. MF, Cortland, N. Y.



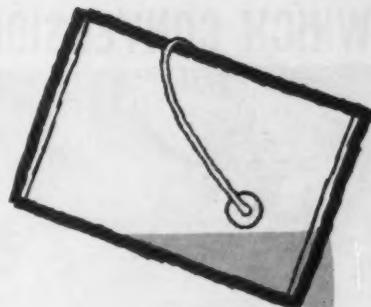
Dry, cleaned air greatly increases the quality and uniformity of sand blasting and spraying techniques in the metal finishing industry. The Heat-Les dryer is a unique, exclusive design which completely eliminates the use of heat-reactivation of the dessicant. The unit is a two-chambered dryer with automatic cycling that switches the air flow from one chamber to the other. The idle chamber is reactivated by means of a small percentage of the dry air leaving the operating chamber. This design permits dew-points as low as -200°F . and complete, automatic removal of oil. The resulting effluent air is cooler than the air on the compressor side of the dryer.

Industrial Batch Ovens

Blue M Electric Company, Dept. MF, 138th and Chatham St., Blue Island, Ill.

The rugged, ultra-modern Blue M series of industrial batch ovens, with exclusive Power-O-Matic control system, is designed to give improved results, better products, and save money.

The control circuit consists of hydraulic thermostat with multiple flexible contacts which energize and de-



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distinctive

finish

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SYNTHETIC PEARL ESSENCE

Formulated for use with practically all coating vehicles... for application by almost any coating method, Nacromer transforms ordinary coating materials into eye-catching "sales-feature" finishes.

Coating users, on the alert for something different to make their products stand out, will be interested in Nacromer coatings because they are different... because they add unusual beauty... and, because they're easy to use.

If you are looking for a new distinctive finish, why not try Nacromer?

NEW 8-PAGE HANDBOOK

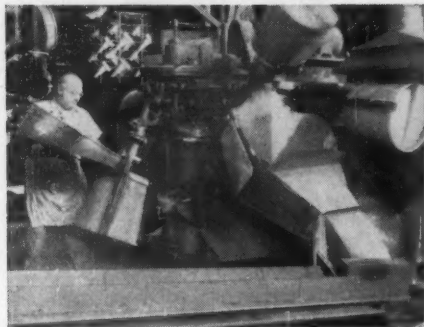
Our new 8-page Nacreous Pigment Handbook and 4-page "Coating with Nacreous Pigments" brochure contain much valuable information on the use of Nacromer. Write for your copies today.



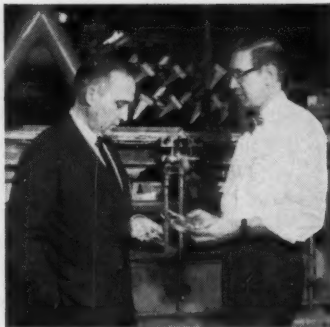
THE MEARL CORPORATION

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WHICH CONVERSION COATING TO USE?



Unloading ends of barrel and rack automatic machines



Henry Blessing inspecting hardware products after treatment

STANLEY HARDWARE CHOOSES KENVERT® NO. 17A

At The Stanley Works in New Britain, Connecticut, one of many satisfied customers, Foreman, Henry Blessing, has several reasons for using KENVERT NO. 17A. Included are:

1. Uniform bright work from day to day without staining on difficult parts such as assembled hinges
2. Good corrosion protection
3. Improved product finish with substantial cost reduction
4. Easy solution maintenance

KENVERT 17A, the premium powder, guarantees the best in brightness, corrosion protection, bath life and uniformity of finished product in a single dip treatment. Won't you discover the advantages.....

NEW! Permanent zinc brightner for barrel or rack work—KENVERT 15BR. Test samples available.

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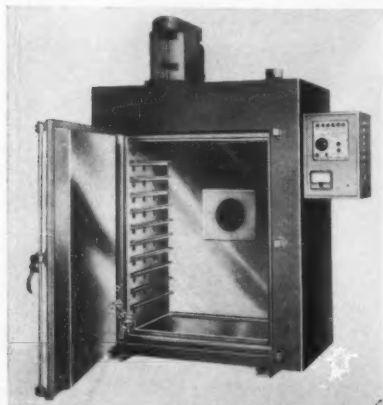
100 East Main Street, Rockville, Connecticut, Phone: TRemont 5-3357

Kenvert manufactured by Nicromatic Ltd., Toronto, Canada

24 Distributors in major industrial United States cities

KENVERT PRODUCTS SOLVE UNUSUAL METAL FINISHING PROBLEMS

energize each increment of multiple heating element as necessary to provide automatic proportioning wattage control. The oven always operates at



minimum wattage input in relation to temperatures and work load, with no switching of a fixed wattage "on" and "off."

The oven has built-in safety overload protection, neon pilot lamps, efficient reliable low-volt fused power relay assembly, double wall housing of heavy gauge steel, triple side walls 4" thick with fiberglas wool insulation, double wall door, refrigerator type hinges and positive latch. The inner chamber finished in high-temp aluminum paint, the exterior of grey hammerloid enamel. There are angle-iron shelf supports every six inches. Other unique features include dual scale indicating pyrometer, safety door switch, motor starter and overload protection, ball bearing motor and turbo-blower.

Temperature Controller

*Edwin L. Weigand Co., Dept. MF,
7500 Thomas Blvd., Pittsburgh 8, Pa.*

The new type PC Chromatrol electronic controller gives highly sensitive temperature control, within 1°F., up to 600°F. The stainless steel sensing element is a very small bullet-probe only 1" long and 1/4" in diameter. The pre-



aged thermistor probe may be located in immersion wells up to 100 feet away from the amplifier-relay cabinet using inexpensive light-gauge twisted lead wire.

Loads up to 10 KW can be controlled directly without a separate magnetic contactor. It may be used on 120, 208 or 240 volts, 60 cycles. The scale covers a dual-range from 25° to 225° F. or 200° to 600°F. The dial-plate control is removable from the amplifier-relay for remote location up to 30 feet away. Thus all controls may be mounted at a single location.

CORRECTION

A recent development item appeared on page 94 of the December 1959 issue regarding portable solution filters manufactured by *Industrial Filter and Pump Mfg. Co.*

The item states that the 1200 gph model of the new type 118 portable filter offers 60 sq. ft. of filtration area. It has been brought to our attention that the filtration area should read 30 sq. ft. instead of 60.

Manufacturers' Literature

Product Guide

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

A brochure is available which is a general guide to the above firm's products and processes including chemical products, organic coatings, metals, and plating products and processes.

Ion-Exchanger Control Valve

Graver Water Conditioning Co., Dept. MF, 216 W. 14th St., New York 11, N. Y.

Monotrol, a new single control valve for zeolite softeners, ion exchange units and filters, is the subject of Bulletin WC-122, which discusses design, operation and construction details of the cast iron unit and the exclusive all-plastic unit for corrosive service. Among the features covered are pilot control, hydraulic pressure actuation and provision for no leakage and low pressure loss.

Schematic drawings of flow are included as is a guide to valve construction for the various corrosive and non-corrosive services.

Metal Processing Equipment

Pennsalt Chemicals Corp., Dept. MF, Three Penn Center, Philadelphia 2, Pa.

A 15-page booklet with a heavy weight cover describes the range of machines, materials and manpower services the above manufacturer offers for every type of metal processing requirement.

Included are belt conveyor-type washers, monorail-type conveyor washers, rotary drum washers, sheet steel washers, automatic spray washers, agitating washers, automatic coating machines, automatic phosphating machines, drying and paint ovens, paint spray booths, and a number of other machines. The brochure also includes discussion of the firm's complete custom-built finishing systems.

Mask-Holding Clamps

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A brochure describes mechanical and air-operating clamps for holding masks and parts, and standard and

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And you get prompt delivery from ample factory and nearby distributor stocks.

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special fixtures used to speed up production in color decoration of mass produced products.

Graphite Heat Exchangers and Steam Jets

National Carbon Co., Dept. MF, 535 Fifth Ave., New York 17, N. Y.

A new 12-page illustrated bulletin on Karbate impervious graphite immersion heat exchangers and circulating steam jets for heating or cooling corrosive solutions in all types of tanks has separate sections on plate, bayonet, and coil type immersion heat exchangers, including general descriptive, installation, and operation information. Dimensioned sketches of each type give complete construction details, and

tables present information on weights and effective surface areas. Specifications on circulating steam jets include dimensions and installation instructions.

Nomograms and curves present design information, and sample calculations illustrate the proper application of the equipment under a wide range of operating conditions. Catalog Section S-6620.

Products and Processes

Neilson Chemical Co., Dept. MF, 2300 Gainsboro, Detroit 20 (Fern-dale), Mich.

A bulletin is available outlining the principal types of products manufactured by the above firm. Included is in-

When You Buy Silver Anodes . .



PAY FOR THE METAL DON'T PAY FOR SPECIAL SHAPES

With Handy & Harman rolled anodes, you buy exactly what you need in length, width and thickness . . . your initial cost is lower and you've got less cash tied up in inventory.

Another Handy & Harman "added anode attraction" is the range of available finenesses. If you don't need extra fineness, you can specify exactly what you want, and get it. As always, standard requirements are fully met with Handy & Harman's 999 + FINE. And, you can specify any fineness above that grade for your particular needs.

We'd like very much to review with you your anode costs and show you how—with Handy & Harman rolled anodes—you buy the *metal* you need, *not* the shape.

When all is said and done

Handy & Harman's Refining Division is very much interested in your left-overs. Your silver plating solutions, sweeps, scrap and waste get the most *rewarding* attention when you send them to us. Accuracy with what is yours is the basis on which this service is offered. Address your next shipment to the nearest refining station listed below and profit thereby.



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			1900 W. Kinzie St. Chicago 22, Ill.

formation on zinc and iron phosphate coatings, phosphate and oxide conversion coatings for aluminum, rust removers, alkaline cleaners, and special treatments.

Degreasing-Phosphating- Painting Systems

Industrial Division, G. S. Blakeslee & Co., Dept. MF, 1844 South Laramie Ave., Chicago 50, Ill.

Integrated, trichlorethylene-based degreasing, phosphating and painting systems for the new "Tri-Finish" process are introduced, along with an explanation of the new process and the costs involved, in a new 6-page, illustrated catalog.

Explosion-Proof Controls

Partlow Corp., Dept. MF, 531 Campion Road, New Hartford, N. Y.

A two color, four page booklet describes explosion-proof controls, indicating, non-indicating and recording.

Coated Work Gloves

Mine Safety Appliances Co., Dept. MF, 201 N. Braddock Ave., Pittsburgh 8, Pa.

A broad line of coated fabric work gloves for industrial hand protection are described in a bulletin recently issued.

The four-page folder, Bulletin No. 1315-1, illustrates basic types of glove

materials available, including neoprene, natural rubber, and vinyl plastic in standard, flexible, and super-flexible styles. Glove linings are listed as jersey, cotton flannel, and interlock fabric.

Included in the bulletin is a chart evaluating the chemical resistance of glove materials to a wide variety of acids, caustics, ketones, hydrocarbons, and solvents. Specific industrial applications for each type of glove are also provided.

Environmental Test Equipment

Associated Testing Labs., Inc., Mfg. Div., Dept. MF, Clinton Road, Caldwell, N. J.

A new two-page, two-color short-form catalog describes and illustrates thirteen different types of environmental test equipment.

Demineralizers

Cochrane Corp., Dept. MF, 17th St. below Allegheny Ave., Philadelphia 32, Pa.

A four-page bulletin, No. 5819, on a new line of standardized "Uni-Pac" packaged mixed bed demineralizers contains information on the use of demineralization process eliminating variables in water and their effects on product quality control.

Impervious Graphite Equipment

Falls Industries, Inc., Dept. MF, Aurora Road, Solon, Ohio.

Revised to include the latest impervious graphite processing equipment, as well as current costs as of Dec. 1959, this booklet contains a typical drawing or illustration of each type of equipment, lists the standard models available, and provides the approximate cost per square foot of heat transfer area for exchangers, or other appropriate cost unit for other types of equipment.

Fire Extinguishers

Ansul Chemical Co., Dept. MF, Marinette, Wis.

This new catalog lists a complete line, including hand portable extinguishers, stationary fire equipment, piped systems and large capacity mobile equipment such as fire jeeps and trucks.

Hand portable extinguishers shown in the catalog cover requirements for Class A, B and C fires as well as combustible metal fires.

Anodizing Costs

Reynolds Metals Co., Dept. MF, Richmond 18, Va.

What is the cost of anodizing aluminum? Can anodized parts be formed? How much heat can anodic films withstand? Does anodizing change the dimension of a part? Answers to these and similar questions are found in a new booklet, "Questions and Answers about Anodizing," just published.

Waste Treatment

Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. MF, Wayne and Windrim Aves., Philadelphia 44, Penna.

A new industry bulletin B97-2, entitled "Instrumentation for Treatment of Industrial Wastes" is a compilation of article reprints. It offers some case histories of how instruments are applied to industrial waste treatment systems to prevent stream pollution.

Steel Shot

Pangborn Corp., Dept. MF, Hagerstown, Md.

Important factors to be considered in the selection of steel blast cleaning abrasives are outlined in a new 20-page booklet, #2294. Features which make one brand of abrasive better than another are graphically presented along with photographs showing how poor quality shot can prove costly regardless of initial price.

BUSINESS ITEMS

Rampe Expands Plant Space

100% plant expansion to keep pace with the growth of its line of precision tumbling machines has been started by *Rampe Mfg. Co.* on its present factory site at 14915 Woodworth Ave., Cleveland 10, Ohio. The enlarged facilities, doubling present factory space, will provide room for a three-fold production increase in the near future. The company, long a producer of barrel-finishing equipment, including related motor drive components, expects that the new plant expansion will be completed early this year.

Neilson Chemical Company Appoints New Representatives

The Neilson Chem. Co., Detroit 20,

has recently appointed *Zak-Cowen and Associates, Inc.*, 7730 Carondelet, St. Louis 5, Mo., as sales and service representatives for their products. They will be servicing accounts in the State of Missouri, sections of Kansas, Illinois and Indiana.

Zak-Cowen representatives have been working under an intensified training program with the Neilson's service technicians and will be in a position to give sales and service advice to the many customers requiring information in their territory.

R. C. Mahon Promotes D. C. Trueman

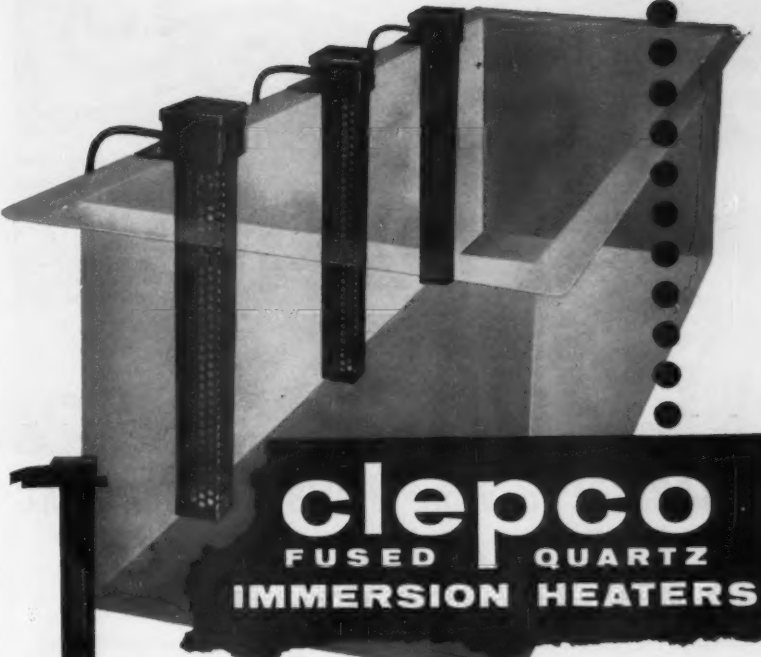
D. C. Trueman, chief draftsman in charge of engineering for the Steelweld Division of *The R. C. Mahon Co.*,

Detroit, has been named assistant general manager of the unit. His position is being filled by *William Hoenes*, formerly chief estimator, with *W. M. Gordon* succeeding Hoenes as chief estimator.

Trueman joined the organization in 1946. Before that he was in the engineering section of Taylor-Winfield's fabrication division in Detroit.

Anachrome Corp. Opens Arizona Division

Anachrome Corp., affiliate company of *Anadite, Inc.*, announces the opening of their new Arizona Division located in Tucson. The new division is geared to produce hard anodizing for the electronic and missile industries



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FUSED QUARTZ
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**FAMOUS THROUGHOUT
THE PLATING INDUSTRY**
For Quality, Efficiency, Low Cost Operations

OVER 100,000 INSTALLATIONS
For alkaline or acid heating jobs, you can depend on
CLEPCO ELECTRIC IMMERSION HEATERS

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will meet all your specific needs.

Low Heat Density — Long Life — Vapor-proof Junction Box.

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ARMORHIDE® coating on IBM 305 RAMAC

New metal coating looks like leather and is ten times more abrasive resistant.

Basically a textured plastic finish applied to metal and resembling leather, Armohide is characterized by very high abrasion and chemical resistance. Similar to laminated Vinylite, Armohide does not require expensive solvents and is sprayed on metal at a minimum of 60% solids at the gun.

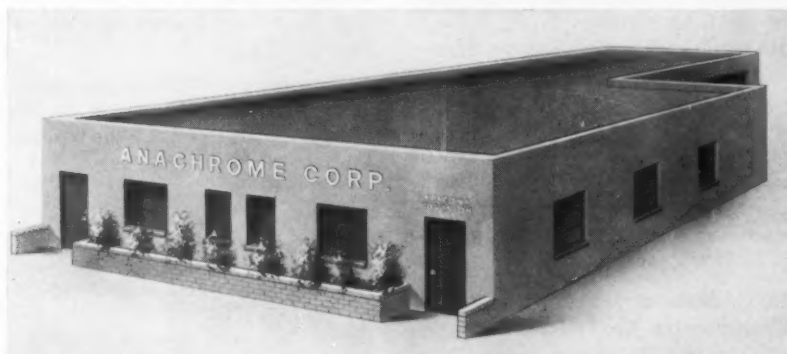
Thus Armohide is a new and entirely different kind of finish with physical and chemical properties unlike any other finish.

Write today for free booklet and sample panel.



in the Tucson-Phoenix-Fort Huachaca area. A major portion of the new plant's production program will be devoted to the creation of hard anodized coatings on strategic aluminum

parts used in electronics. The new division was established to give the new and rapidly growing electronic and missile industries of Arizona a local source for hard anodizing.



Show here is Anachrome Corporation's new Tucson, Arizona hard anodizing facility which is over 3000 sq. ft. The new facility will serve the electronic and missile industry of the Phoenix and Tucson area.

Laplace Inaugurates 24-hr. Delivery

Nitric acid in carboys, drums or bulk quantities of 1,000 gallons or more is now being delivered within 24 hours to users in the Middle Atlantic area, announces *L. J. & M. Laplace Chemicals*, East Paterson, N. J.

According to the company, this shortened delivery schedule presently applies to customers in New York, New Jersey, eastern Pennsylvania, and western New England. Deliveries to more distant points such as Pittsburgh and Boston, however, are also reported to be faster.

The company reports that the speed-up in delivery and lowering of minimum order requirements were made possible by a recent expansion of their bulk carrier and delivery truck fleet.

Pennsalt Chemicals to Build New Plant in Atlanta

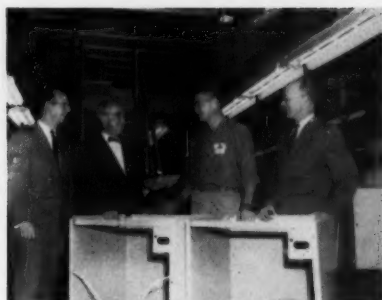


Pennsalt Chemicals Corp. will invest about \$500,000 in a new blending, packaging and warehousing plant at Atlanta, Ga. Scheduled to go on stream in the Spring of 1960, the Atlanta plant will be the seventh unit devoted to production of specialties added in the past five years.

The Atlanta plant will be constructed on a ten acre site served by a direct rail spur and express highway permitting fast service to area customers. A modern one-story structure, it will provide production and warehousing facilities.

Fortune Receives Award from Maytag

James H. Fortune, 29, a working foreman in the Maytag Company's Plant 2 paint department, has received \$1,723.95 for three ideas he had submitted under the firm's work simplification program. Accounting for the major share of Fortune's "fortune" was \$1,500 for his maximum award winning idea involving elimination of



temporary braces used on the backs of appliance cabinets in transit to the paint department from the sheet metal area. The remaining \$223.95 was for his suggestions to change the method of shipping angle brackets from the paint department to dryer assembly and to improve the handling and storing of colored dryer parts.

A native of Knoxville, Iowa, Fortune is a graduate of Melcher, Iowa high school and started at Maytag in September, 1948. Above, at the awards presentation are, from left, *Clarence Eaton*, head of the paint department; *George M. Umbreit*, executive vice-president and treasurer; Fortune, and *J. F. Biggane*, manager of industrial engineering.

Personnel Changes Announced by Parker Rust Proof

Parker Rust Proof Co. has added *Wallace Howells* to their staff serving the Minnesota area.

An engineering officer in the U. S. Maritime Service during the war, Howells graduated from the University of California and undertook post graduate work in sales analysis and chemistry. Joining Parker after many years as assistant sales manager at Braun Knecht Heimann Co., chemical sup-



Wallace Howells



Joseph Van Cooley



DO YOU WANT TO SAVE MONEY?

Here is how to solve some waste disposal problems -and reduce costs at the same time

IonXchangers of several types, and various units of allied equipment, as designed and manufactured by Illinois Water Treatment Company, offer a number of money-saving opportunities. For example, consider the waste water from rinse tanks. Contaminants can be removed and concentrated, and pure water returned to the rinse system. In some instances, chrome and other valuable metals can be recovered from the rinse water. For another example, consider plating solutions which, under many circumstances, become polluted and less efficient. The contaminating materials can be removed, recovered if valuable, and the bath maintained at high purity. Also, impurities found in water supplies, to spoil the appearance

of plated or anodized parts, can be removed so that uniform quality of work is assured. Spent metal finishing solutions such as aluminum bright dip can be purified for re-use. Toxicity in otherwise-clean waste can be eliminated. All of these treatments will, in one way or another, contribute substantially to improved products, more efficient operations, and lowered costs. Specific possibilities of applications of ionXchange in your plant can be determined by talking to your ILLCO-WAY representative.



IonXchanger recovery unit for plating solutions

ILLINOIS WATER TREATMENT CO.
840 CEDAR ST.,
ROCKFORD, ILLINOIS

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Can.



pliers, he brings a sound background to serve industrial firms in the twin cities area.

Joseph Van Cooley has been transferred to Chicago as technical representative in the Central area of Illinois.

This Air Corps veteran studied at Michigan College of Mining and Technology at Houghton, Michigan, and was formerly with American Brass Co.

Newly transferred to Marion, Ohio, *Ken James* will be technical representative in this area.

Romito Promoted by Allied Chemical

Appointment of *Virgil A. Romito* as director of production of *Allied Chemical's* General Chemical Division has

**STOP
CORROSION
STOP
CONTAMINATION**



Photo courtesy Hanson-Van Winkle-Munning Co.

MANHATTAN RUBBER LINING PROTECTS COSTLY PICKLING AND PLATING EQUIPMENT... *Permanently*

- THICK, MULTIPLE CALENDERED SHEETS
- INSEPARABLE RUBBER-TO-METAL BOND
- ELIMINATE DANGEROUS "STRAY CURRENTS"
- NATURAL OR SYNTHETIC RUBBER
- WON'T HARDEN, CRACK OR OXIDIZE
- TESTED UNDER HIGH VOLTAGE

Be certain of lifetime protection for your costly equipment and protection against contamination of expensive plating baths. Specify Manhattan lining on your next tank lining job.

RM1039

MANY MANHATTAN LINED TANKS HAVE BEEN IN CONTINUOUS USE OVER 30 YEARS!

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RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY



ENGINEERED
RUBBER
PRODUCTS
... MORE USE
PER DOLLAR

been announced recently. Until his appointment last year as maintenance manager, Mr. Romito had been plant manager of the division's largest producing facility, Delaware Works at North Claymont, Del., for five years.

He joined the firm in 1933 as a draftsman, later serving in a wide range of production, engineering and maintenance posts at plants in Newell, Pa.; Chicago, Ill.; Camden, N. J.; Edgewater, N. J., and at the General Chemical Defense Corp. plant operated for the War Department during World War II at Point Pleasant, W. Va.

Mr. Romito is an alumnus of Carnegie Institute of Technology where he received a BS degree in mechanical engineering in 1932. While a student at Monessen High School, Monessen, Pa.,

Mr. Romito also worked for the company during summer vacations at its Newell, Pa., Works.

Claydon Elected V. P. of Carborundum Co.

John F. Claydon, general manager of the Coated Abrasives Division of The Carborundum Co., was elected vice president of the company by the board of directors at a meeting December 17 in Niagara Falls, N. Y.

Mr. Claydon holds a Bachelor of Science degree in chemical engineering from the University of Minnesota, and studied advanced management at Harvard Business School. He joined the firm in 1935 as an experimental engineer, became an industrial salesman and then manager of the company's



John F. Claydon

Detroit sales district. In 1954 he was promoted to sales manager and, in 1957, was appointed general manager of the division, one of the nation's largest producers of coated abrasives.

Binks to Present Complete Curriculum at Spray Painting School

The spring session of the Binks Mfg. Co.'s spray painting school will cover all phases of spray finishing. Particular emphasis will be placed on two of the latest developments in the spray finishing industry — airless and electrostatic spray painting.

The school is tuition-free, as usual. John Adams, newly appointed director of customer research, will conduct all classes. A total of six sessions will be held during the first half of 1960. Classes will be held on January 4-8, February 1-5, March 7-11, April 4-8, May 2-6, and June 6-10.

Classes are limited to 25 students per session so that each student gets maximum attention. Instruction is given on all types of spray finishing equipment, including guns, pumps, compressors, spray booths and other related equipment. Tips on how to select the right equipment for the job, plus instruction on maintenance and care of this equipment will be fully covered.

The school is open to all interested. Enrollment can be arranged by writing to B. J. Hedger, Binks Mfg. Co., 3114 Carroll Ave., Chicago 12, Ill.

Udylite Opens Larger Quarters in Philadelphia-Camden Area

A fully equipped laboratory for prompt analysis of electroplating solutions is part of the new warehouse and

office facilities of the *Udylite Corp.* serving platers in the Philadelphia-Camden area of Pennsylvania and New Jersey. The new address for the regional branch is 1400 Suckle Highway in Pennsauken, N. J., a suburb of Camden. A branch office was formerly located at 2818 East Belgrade St., Philadelphia.

The 6,000 square-foot building in which the new branch is located will provide additional warehouse space as well as laboratory facilities. Both improvements are planned to cut the time for service and for deliveries in the region. The new installation is under the direction of *William Moyer*.

M & T Elects Executive Vice President

The election of *A. J. Fisher, Jr.*, as executive vice president, has been announced by *Metal & Thermi Corp.*

Mr. Fisher, joined the firm in 1955 as a member of the market research development department. He was appointed general sales manager in 1956. In 1958, he was named general manager of the newly formed Welding Products Division.

Prior to his association with M & T, he was manager of chemical sales development for U. S. Industrial Chemicals, Inc., New York, and president of U. S. Polymeric Chemicals, Inc., Stamford, Conn. He is former secretary and a director of the Chemical Market Research Association, and also former secretary and a director of the Commercial Chemical Development Association.

Mr. Fisher is a native of Rochester, N. Y. He was graduated from Phillips



A. J. Fisher, Jr.

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Exeter Academy in 1932, and received his bachelor's degree in Chemistry from Princeton University in 1936.

Industrial Filter Appoints Regional Sales Managers

Frank M. Macioce and *C. M. Weege* have been appointed regional sales managers of *Industrial Filter & Pump Mfg. Co.*

With the firm ten years as a sales engineer, Mr. Macioce has been engaged in the design of ion exchange and waste treatment equipment. He is a graduate of the College of the City of New York from where he received his Bachelor of Science degree in 1934 and his Chemical Engineering degree in 1935. He is a member of the American Chemical Society and the Central

States Sewage and Industrial Waste Assn.

Prior to his present association, Macioce was on the engineering staff of American Cyanamid Company. During World War II, he served for four and a half years as an officer in the United States Navy, charged with engineering duties related to aircraft.

Weege graduated from the U. S. Merchant Marine Academy and received a commission in U.S.N.R. in 1947. After serving 14 months in Korea, he studied philosophy and marketing at DePaul University while being employed as sales representative by Remington Rand, Inc. of Chicago. He later served as assistant manager and branch sales office manager at San Francisco offices of C. E. Church Divi-

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for help with your
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sion of American Radiator Standard Sanitary Corp.

R. P. Hayes Named Chief Estimator for Udylyte



R. P. Hayes

Promotion of *Rutherford P. Hayes* to chief estimator of the *Udylyte Corporation* has been announced recently. He formerly was project estimator for the company, the largest supplier to the electroplating industry.

A graduate of the University of Wisconsin (Class of '52), he worked as an industrial engineer for Alcoa before joining Udylyte this year.

During the Korean conflict Mr. Hayes served as a lieutenant in the Military Police. He is a member of Alpha Delta Phi fraternity and the Troyton Manor Homeowners Association.

Sales Service Mfg. Co. Appoints Payne

Wesley F. Payne has been appointed chief field engineer in the Tri-Matic Oscillating Abrasive Belt Grinder division of *Sales Service Mfg. Co.*, St. Paul, Minn. He will be responsible for new application service in the division.

Enthone Reorganizes Middle Atlantic Sales Force

Joseph R. Eisele has been promoted to district sales manager by *Enthone, Inc.* of New Haven, Conn. He will manage the newly created Middle Atlantic sales territory and will direct the activities of three district sales engineers. The new territory will include New Jersey, Eastern Pennsylvania, Delaware, Maryland, the District of Columbia and Virginia.

Mr. Eisele joined the firm in 1948,



Frank M. Macioce



C. M. Weege

and has served as sales engineer for New Jersey and a portion of eastern Pennsylvania since that time. Previously he was employed as a plating chemist at the General Electric Co. plant in



Joseph R. Eisele

Bridgeport, Conn. He holds the degree of bachelor of chemical engineering from Rensselaer Polytechnic Institute, Troy, N. Y. and is a member of the Newark Branch, A.E.S. and the Rensselaer Club of New Jersey.

Joe H. Shockcor and Hugh V. McGuire will assist Mr. Eisele as district sales engineers. Mr. Shockcor will handle east central Pennsylvania and the southern part of the territory. Mr. McGuire will serve the northern New Jersey district.

Mr. Shockcor has been with the company since his graduation from Lehigh University in 1950 with a B.S. degree in chemical engineering. He worked for two years as research chemist in the laboratory before becoming a sales en-



Joe H. Shockcor



Hugh V. McGuire



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- Carefully-controlled standards of purity and uniformity
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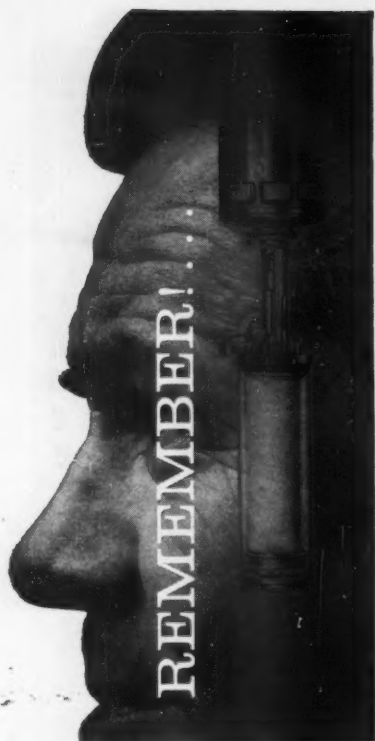
300 PARK AVENUE, NEW YORK 22, N. Y.

gineer in the Pennsylvania area. He is a member of the Lancaster Branch, A.E.S. and a delegate to the Supreme Society.

Mr. McGuire is a graduate of Rutgers University and has had 14 years experience in metal finishing. He joined the firm in 1958 as assistant to the sales manager. He was formerly employed by Hanson-Van Winkle-Munning Co. as manager of general equipment sales. He is a member of the Newark Branch, A.E.S.

Pritchett Succeeds Mearns at Du Pont

Andrew K. Mearns retired December 31 as Philadelphia regional automotive refinish sales manager of the Du Pont



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 for faster, higher quality
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- Keeps surface clean regardless of solution level.
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Company's Fabrics and Finishes Department, after a career of more than 42 years with the company. He is succeeded by *William F. Pritchett*, now assistant refinish sales manager in the Philadelphia region.

Mr. Pritchett joined the company in 1918, and soon became a correspondent in the paint sales organization in Philadelphia. He later became a salesman, first in the Pittsburgh, and then in the New Jersey areas. He was promoted to trade sales supervisor in the Cleveland region in 1947, refinish branch manager in Detroit in 1950, and refinish sales manager in the Kansas City region in 1952. After the Kansas City regional refinish sales office was merged with those in Chicago and Dallas earlier this year, Mr. Pritchett was sent to Hawaii to assist in establishing refinish and trade sales offices there. On completion of this assignment, he became assistant refinish sales manager in the Philadelphia region.

Mr. Pritchett was born in Camden, N. J., and attended Goldey College in Wilmington.

**Wyandotte Chemicals Corp.
 Completes Atlanta Expansion**

Wyandotte Chemicals Corp. has announced completion of its Atlanta, Ga., plant expansion program. Production of the complete line of J. B. Ford Division cleaning and sanitizing products has just begun, and shipments were scheduled from Atlanta to the entire southeastern area beginning January 4, 1960.

Changes at Carborundum

Four major changes in the management of *Carborundum Co.* research and development are announced. *Major General Leslie E. Simon*, U. S. Army Ret., presently vice president and director of research and development, has resigned from that position for reasons of health, and becomes staff director of research and development, acting in a consulting capacity to the president. *Dr. G. M. Butler, Jr.*, manager, Engineering Research Branch of the company's Research and Development Division, has resigned from that position to become the director of engineering and research for a large corporation located in California. *Donald G. Sturges*, now associate director, becomes director of research and development. *Colonel Paul N. Gilton*, U. S. Army Ret., manager of the Basic Research Branch of the division,

will become director of research and development for *Carborundum International S.A.*, Geneva, Switzerland.

Hilton Smith Joins Belke

Belke Mfg. Co., announces appointment of *Hilton M. Smith, Jr.* as sales representative in Ohio, Southern Indiana, Kentucky and Tennessee.

Mr. Smith's extensive experience in plating equipment and processing includes six years as sales representative for *Hanson-Van Winkle-Munning Co.* in Rhode Island, Massachusetts, New Hampshire and Maine, Wisconsin, and northeastern Illinois.



Hilton Smith

A native of New Jersey, Mr. Smith received his B.S. degree from New Jersey State Teachers College and has taken graduate work in chemistry, sales engineering, and sales management at Rutgers University and the University of Wisconsin. Prior to separation from the U. S. Navy as lieutenant, he served as a pilot with anti-submarine squadrons.

He is a member of the A.E.S., having held office in the Boston branch and is currently librarian of the Milwaukee Branch. He was instrumental in the formation and support of the electroplaters' school at the Racine Vocational School, Racine, Wis. in 1958-1959.

**American Buff Appoints
 Two Regional Salesmen**

The appointment of *Ronald W. Greiner* and *Gerald L. Swartz* as salesmen has been announced by *American Buff Co.*, Chicago.

Greiner, who will represent the com-

pany in Southeastern Michigan, was in the engineering and estimating section of a Detroit plating and metal finishing equipment manufacturing company for 5 years. He has had considerable experience in the installation of automatic plating equipment. A graduate of the Detroit Institute of Technology, he holds a Bachelor of Science degree in chemistry.

Swartz, who will service the New England area, has been proprietor and manager of an appliance center in Ypsilanti, Mich. for the past 5 years. For 7 years prior to this, he was traffic



Gerald L. Swartz

department general foreman for Kaiser-Fraser Corp., in charge of new car shipments and deliveries.

New Infrared Oven Company Formed

Four veterans in the infrared field have disassociated themselves with previous connections and have formed a new company, under the name of *Radcor Inc.* The combined experience of these four men, which includes *Jack Barber, Paul H. Krupp, M. M. Might* and *J. R. Pigman*, totals approximately 70 years.

Jack Barber, before entering the infrared field in 1943, was an electric utility engineer. He has written and delivered many technical papers before engineering groups, and is particularly well known throughout the automotive industry.

Paul Krupp, who has been associated with the infrared business since 1941, has been engaged in the promotion and sales activities. He has written articles pertaining to infrared and its uses for many of the trade magazines.

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Featuring
VAPO-VENT[†]
VAPOR and LIQUID
TIGHT VENTING ASSEMBLY
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NEO-TITE[†]
VAPOR and LIQUID
TIGHT ASSEMBLY
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THERM-X-RED, a superior line of immersion heaters, presented by N.J. THERMEX, introduces a new innovation of vapor venting to eliminate internal explosion in Quartz heaters. The VAPO-VENT assembly provides a venting system for expanding gases, a completely liquid sealed head assembly and an extremely versatile unit which permits field repair with standard replacement. These exclusive THERM-X-RED features are further aided by the NEO-TITE vapor and liquid tight assembly which protects the heating elements in both Quartz and Steel units. Here at last, is a thoroughly versatile unit permitting even accidental total immersion in highly corrosive chemicals with no harm to the equipment.

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COMPANY, INC.**

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Choice territories open for sales representation. Write for details.

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I. J. Barber



P. H. Krupp



M. M. Might

Most of Mr. Might's activities for the past sixteen years have pertained to laboratory testing, research, application data and field service work with infrared users.

J. R. Pigman's experience in the infrared field started in 1941. He has seen the infrared oven business grow from a few portable types to large production ovens with intricate control circuits for automated manufacturing lines; and under his direction many such ovens have been developed.

The new company will be located in a modern manufacturing plant at Bradner, Ohio, which is in the vicinity of Toledo.

In keeping with their experience, and the needs of the industry, the new organization will have complete labora-



J. R. Pigman

tory facilities for commercial testing for those jobs which require it. Ovens will be furnished for using all types of electric infrared sources.

Lea-Ronal Honored

Lea-Ronal, Inc., of Jamaica, N. Y., has been selected by the Commissioner of Patents to be the organization representing the *Electroplating Industry* in the Chemical and Sythetics Division exhibit to be held from February 15th to March 11th in the main entrance hall of the *Department of Commerce Building*, Washington, D. C. The Department has also invited fifteen companies representing other branches of this Division to exhibit their contributions toward progress in industry. Following their display at the Department

of Commerce, the exhibits will be moved to the *Franklin Institute* in Philadelphia and will be shown there from March 14th to April 11th.

The purpose of the Patent Office in promoting these exhibits is to draw national attention to the intense research and development continually carried on by American industry as exemplified by the selected companies, and which are reflected in the activity of the Patent Office. The exhibit symbolizes the American Spirit of Free Enterprise which relies so heavily on the honesty and effectiveness of the Patent System evolved in the United States.

From its inception 10 years ago, Lea-Ronal has been engaged extensively in research and development of processes for the metal finishing industry. It has been granted numerous patents for the numerous electroplating processes now being extensively used commercially. The company feels highly honored that its broad work in this field has been so signally recognized by the Commissioner of Patents as to merit its selection to represent the plating industry.

Thanks for Your Christmas Cards!

At this time we would like to acknowledge and thank all those who, during the past month, have sent us Christmas cards and 1960 calendars.

Adelphi Paint & Color Works, Inc.
Advance Process Supply Co., Inc.
Alberts' Plating Works, Inc.
Alpha Metals, Inc.
Amatore, A.
American Smelting & Refining Co.
Anadite Inc.
Aurilyle Process Co.
Bakinow, Leo
Barker Bros., Inc.
Beaver, H. Leroy
Benach Advertising Agency, Henry
Beresford, L. J.
Briganti, Anthony P.
Briganti, Frank
Carborundum Co., The
Carlton-Cooke Plating Corp.
Celanese Chemical Co.
Chalfant, Chas. N.
Clark Equipment Co.
Clinton Supply Co.
Cochrane Corp.
Corigliano, Greg
Crane, R. P.
Doyle, Ed
Draper, W.
Electro-Glo Co.
Errico, Tony
Foulke, Don

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- PERCHLOROETHYLENE
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- SWIMMING POOL CHEMICALS
- OIL ABSORBENT
- ACID TANKS AND CONTAINERS
- HAND CHEMICAL PUMPS

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PPI Titanium Scrap Saver Anode Baskets
Completely Made of Titanium Metal with Rugged Welded Frame . . . Built to Last Almost Indefinitely When Used in Nickel or Acid Copper Plating Solutions

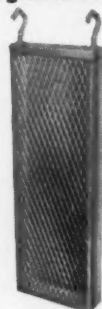
Advantages that will make you money

- Nickel and Copper anode scrap makes perfect electrical contact to titanium basket and draws full current
- Solutions have no effect on titanium metal either with or without current
- Eliminates the hazards of plating failures that occur when using plastisol coated steel baskets
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NOTE: Titanium metal can't be used in cyanide or fluoborate solutions

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 General Color Printing Inc.
 Graver Water Conditioning Co.
 Hall Industrial Publicity, Inc.
 Hariton, Harry
 Hinterleitner, Ernest J.
 Instituto Electroquimico, S.A.
 Jaqua Co., The
 Jumer, John
 Kellner, Dr. Henry L.
 Kelly, Clyde
 Kim, Yona
 Kohler Co.
 Kosmos, John
 Kovatis, P. Peter
 Kushner, Dr. Joseph B.
 Lea Mfg. Co.
 Lewis, Richard S.
 Lindale Equipment & Supply Corp.
 Little, Inc., Arthur D.
 Marquardt Corp.
 Maytag Co., The
 Merchants Metal Trimming Co.
 Metal Industry (United Kingdom)
 Morgan, Grady
 National Paint, Varnish & Laquer Association
 PIC Design Corp.
 Pfizer & Co., Inc., Chas.
 Pinner, R.
 Pittinato, Dick
 Pollack, Martin
 Powers, John A.
 Rapid Electric Co.
 Sandoe Laboratories
 Sandoz, Inc.
 Schonfarber & Associates, Inc., Gordon
 Shore, George
 Sel-Rex Corporation
 Serota, Louis
 Shaw, Ken
 Sigoli Metal Plating Co., Inc.
 Standard Rate & Data Service, Inc.
 Steiger, A. J.
 Tedeschi, Robert
 Tyson & Co., O. S.
 Van Norman Industries Inc.
 Wah Fong Electric Co.
 Walter, John J.
 Wardell, D. L.
 Wernick, Dr. S.
 West Virginia Pulp & Paper Co.
 Whirlpool Corp.
 Wooton, Paul

been active in the plating field. The company was established in 1946 by Roter and Barker and, in the ensuing 13 years, developed into one of the largest job shops in the San Fernando Valley of Southern California. The plant is equipped for all types of plating, including printed circuitry work, for the aircraft, electronics and missiles industries.

Roter intends to continue in the plating industry and will announce his plans shortly.

Jack Abramson, finishing supervisor for Wilshire Mfg. Co., 4865 San Fernando Road, Los Angeles, reports the firm has installed a new chromium department equipped to process parts for barbecue sets, a new addition to the company's line. It also produces fireplace sets and is equipped to brass plate andirons, screens, and metal frames for fireplace sets.

Earl Coffin, a founding-member of Los Angeles A.E.S. branch, in mid-December was back on the job as a sales engineer for L'Hommedieu in Los Angeles after completing a nine week round-the-world tour by air with Mrs. Coffin.

Flying all the way, the Coffins covered more territory than President Eisenhower on his 11-country tour in December. The Coffins visited some of the countries in which the president made calls, "But with smaller crowds to welcome us," said Earl with a grin. Earl and his wife visited Japan, Hong

Kong, Thailand, India, Italy, Austria, Germany, Switzerland, France, and England.

The combined Los Angeles sales office of both the Durez Plastics and Western Chemical Divisions of Hooker Chemical Corp. has been relocated at 6277 East Slauson Ave., Los Angeles 2, Calif. (phone Overbrook 5-8910), beginning January 11, 1960.

These offices are to be consolidated with modern warehouse facilities for the company's products in the new warehouse of Interamerican Warehouse Corp. at this location, where all company stock for the area will be stored henceforth.

One of Chicago's pioneer platers, whose activities in the industry predate World War I, was a visitor in Southern California recently in the person of Charles Abramson, owner of Liberty Plating Co. on Ogden Ave. in Chicago. Mr. Abramson, 75, operated a job shop in the mid-west metropolis since 1916. The ten years or so which he spent working in other shops before striking out for himself in 1916, brings his active years in plating to well beyond the half century figure. Mr. Abramson is the father of Jack Abramson, plating supervisor for Wilshire Mfg. Co., Los Angeles.

Great Western Chem. Co. has opened a Southern California branch office at 4521 Produce Plaza, Los Angeles, with William A. Nairne as general manager.

News from California

By Fred A. Herr



Meyer Roter, co-partner with James Barker in the Art-craft Plating & Finishing Co., 2532 Hollywoodway, Burbank, Calif., reports that he sold his interest in the firm to Barker in December.

Barker is operating the firm with a new partner, who has not heretofore

Here's A "One-Machine-Gang"...

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TO SAVE COSTS

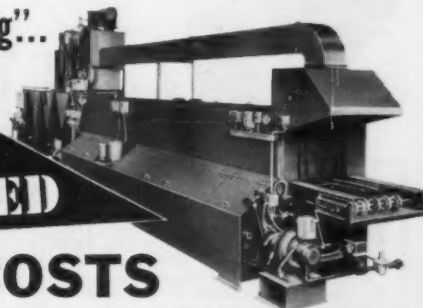
Job Engineered for a plant where pots and pans of aluminum and steel are manufactured, this new A-F Machine washes, rinses, de-ionizes (to prevent lime spotting) and dries the pots and pans spotlessly clean—eliminating further operations before packing.



And, here's an A-F extra... which

A-F JOB ENGINEERED Cleaning and Finishing Machines

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saved money for the pan manufacturers in still another way. They owned a stainless steel conveyor belt, so A-F built this machine around their conveyor belt—an outstanding example of A-F Job Engineering and custom-building.

Do you have a metal cleaning problem? A-F Job Engineering can help you solve it. Why not write today?

This marks the firm's move into the Southern California market after many years of activity in the Pacific Northwest, where it has offices in Seattle and Spokane, Wash., Portland and Eugene, Ore.

Nairne formerly served as a sales engineer in Hanson-Van Winkle-Munning Co.'s Los Angeles office, and later for Alert Supply Co., when Alert became a H-VW-M subsidiary.

Harold R. Smallman, formerly a H-VW-M vice-president in charge of Pacific Coast operations for that firm, is now serving as overall head of Great Western's plating department coast-wide, with headquarters in Richmond, Calif.

George Familian, 54, president, Price-Pfister Mfg. Co., Los Angeles, producers and finishers of plumbing fixtures, died in late-December at Cedars of Lebanon Hospital in Los Angeles. He was also president of Familian Pipe & Supply Co. of Los Angeles.

Two night school training courses in metal finishing and electrochemical

subjects have been announced by Milton Weiner, chemical engineer and plating consultant of Santa Fe Springs, Calif.

Training Program A is offered every Monday night from 7:15 to 9:45 o'clock. The course began January 11 and will continue for 12 weeks. It will cover such subjects as handling of chemicals, preparation of metals, solution purification, sacrificial metals; decorative metals, hard chromium preparation and its solutions; calculation of tank capacities; discussion of such precious metals as silver, gold, rhodium and others; equipment and plant design; and lectures dealing with tin, brass, bronze, electroless nickel, chemical milling, vacuum plating, and plating on plastics.

Training Program B, according to Weiner, will be held for 12 weeks starting March 22, every Tuesday night from 7:15 to 9:45 o'clock. Both classes meet in the Weiner Laboratory, 12631 Imperial Highway, Santa Fe Springs, Calif. Included in the fee for the Electroplating and Metal Finishing course is a free copy of the METAL FINISHING GUIDEBOOK DIRECTORY, published by

Metals & Plastics Publications, Inc., Westwood, N. J.

Program B covers theoretical chemistry and electrochemistry and their applications in electroplating. Included will be solutions, formulas, pH, electron and ionization theory, electrolysis, Faraday's laws, polarization, corrosion and plating variables.

Two executive changes in the West Coast staff of the Carborundum Co. have been announced: M. M. Craft has been named sales manager of the Los Angeles sales district; and E. A. Jape-ly, has been transferred from the sales-managership at San Francisco to sales-manager in the Chicago area.

The 13th annual Pacific Northwest Metals & Minerals Conference will be held at the Sheraton Hotel, Portland, Ore., April 28-30. Several of the technical sessions will be held in cooperation with the American Society for Metals. Arrangements are being made to accommodate an attendance of 500 persons.

Darrel H. Kay has been appointed



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Centrifugal Dryer

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1-h.p. motor—220, 440, 550 volts—2 or 3 phase.
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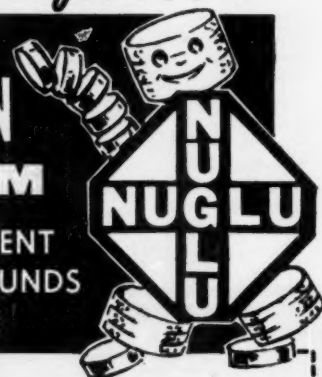
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SPRAY COMPOUNDS
SPRAY SERVICE



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Our Thirty-Third Year

one of the divisional sales managers in the Los Angeles area for the Behr-Manning Co. of Troy, N. Y., manufacturers of coated abrasives and pressure sensitive tapes. Kay's former assignments for the company included service as a field engineer in Southern California, Utah, and Idaho.

Anachrome Corp., an affiliate of Anadite, Inc., South Gate, Calif., has opened a new production plant in Tucson, Ariz., which has been equipped for the creation of hard anodized coatings on strategic aluminum parts for the electronics and missile industries. The company announced the new division was set up to provide a local source for hard anodizing for the growing electronics and missile industries in Tucson and Phoenix.

Joseph E. Trankla has been appointed to the new post of assistant general manager of Anadite, Inc., of South Gate, Cal. Trankla, credited with developing many of the new skills and techniques for hard anodizing of aluminum, was for the last four years di-



Joseph E. Trankla

rector of research & development for the Anachrome Corp., an affiliate company.

American Chemical Corp., a jointly owned subsidiary of Stauffer Chem. Co. of New York and Richfield Petroleum Corp. of Los Angeles, has opened a new headquarters office building at 2112 E. 223rd St., Long Beach, Calif.

The office building is located adjacent to the firm's new petrochemical plant, which is expected to go into production during the early part of 1960.

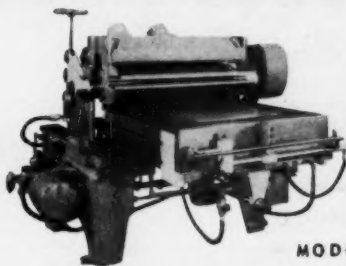
The California Metal Trades Association has elected *Edgar N. Meakin* of San Francisco as its 1960 president. Other officers named at the recent annual membership meeting were *William S. Laidley*, Oakland, 1st vice-president; and *Thomas L. Taggart*, Redwood City, 2nd vice-president.

The California Metal Trades Association acts as employer representative in labor negotiations for more than 400 metal working and processing firms in the San Francisco Bay area.

Recent changes in the Norton Co.'s West Coast staff include the transfer of *Roland L. Jandron* from the post of abrasive engineer in Los Angeles to Seattle, Wash., where he succeeds the recently retired *Arthur W. Cox*. *K. D. Swanson* has been assigned some of Jandron's former responsibilities at the Los Angeles office in addition to his work as field engineer.

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Waterbury Branch

The branch had its December meeting at the Hotel Elton on December 10. Two new members were voted in at the meeting, *Frederick DePalm* and *Samuel Longo*. *Ed Garland* reported that the committee had contacted the library regarding the placing of technical books and that we are about to start purchasing the books. The Entertainment Committee reported that the February Social will be held at the Waterbury Country Club on Saturday, February 6. By-laws have been drafted for the branch and copies of the draft have been distributed for the comments of the members.

Leroy Gabel of Allied Research Products, Inc. spoke on "Zinc Electroplating Baths and Related Chromates." He presented data indicating the effect on efficiency of bath composition. He

showed data indicating the effects of high and low cyanide, high and low metal, high and low caustic and ratio on the operating characteristics of zinc solutions. By interpretation of the data a zinc solution can be formulated which will give the operating characteristics which are desired.

F. A. Schneiders
Publicity

British Columbia Branch

The branch held their December meeting at the Loughheed Hotel, Loughheed Highway, N. Burnaby, on Friday, Dec. 18th. This meeting took the form of a Ladies' Night, to which members, with their wives and guests, came for supper, dancing, and entertainment.

The evening opened with cocktails at 7:45 p.m., and a full turkey dinner commencing at 8:30 p.m. President and Mrs. Shepherd presided and, after welcoming members and guests, handed over to Secretary *Doug Armstrong*, who acted as M.C. for the evening.

After an excellent meal dancing commenced, and throughout the evening there were various prizes, lucky spot waltzes etc., and party games.

The project was planned by an appointed committee consisting of *Bill Craig*, chairman, *Claus Schlossareck*, *Henry Launder* and *Bob Stotz*, who worked with Librarian *Gerry Amos*, and Secretary *Doug Armstrong*, to make this a most successful and enjoyable evening.

Doug Armstrong
Branch Secretary

Indianapolis Branch

Members of the branch were dinner guests of the Delco-Remy Plant at Anderson, Ind. on Monday, Nov. 2. The dinner was served at Don's Barbecue on the By-pass at Anderson, with forty-eight present. *Robert Kessler*, Delco-Remy works manager, spoke briefly about the company products, automotive electric equipment. The program for the evening was a tour through plant #10.

A short business meeting preceded the tour. The secretary's report was read and accepted. As the treasurer was absent, no report was given. Two applicants for membership were presented, *Cecil Overholt* and *Walter W. O'Brien*. The applications were pre-



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sented to the board of managers for consideration. *Les Reynolds*, president, read a letter from the National office about the new sustaining membership taken out by Western Electric Co. Another letter was read reassuring the members that the 1960 convention will be held in Los Angeles.

A vote of thanks was given to *Max Bahler* and all the Anderson members for planning such a nice evening, and at 7:30 p.m. the group drove to plant #10 where guides met the group and explained the many operations of Delco-Remy.

Edna Rohrbaugh,
Secretary

St. Louis Branch

The regular monthly meeting was held Dec. 9 at the York Hotel with 26 members and guests present for dinner. There was 38 present when President *William Piel* called the business meeting to order. This particular meeting was publicized in both daily newspapers, by radio, and the members were telephoned in order to remind them of the meeting and to stimulate attendance. Two guests stated they at-

tended as a result of reading the announcement in the newspaper.

There was no new or old business to be brought before the group and the committee reports were short, so that the meeting was turned over to the librarian who introduced *P. N. (Butch) Burkard*, manager of the Industrial, Railroad and Aircraft Departments of the J. B. Ford Division of Wyandotte Chemicals Corp. Mr. Burkard talked on "Recent Developments in Metal Cleaning," and covered synthetic detergents, organic acids, and alkaline salts, and their functions. He was slightly handicapped by not being able to show his slides since the projector which had been arranged for did not show up, but he did a very excellent job covering the subject without the slides. There was an active question and answer period and the meeting adjourned with a rising vote of thanks for Mr. Burkard.

Ward Kelly
Secretary

Chicago Branch

The branch held its regular meeting on Friday, Dec. 4. *Charles Geldzahler* requested that members who plan to at-

tend the convention in Los Angeles, submit their names to *Paul Glab* so that a group arrangement as to transportation, housing, etc., can be formulated. *Byron Ellis* introduced the speaker of the evening, *Phillip J. Clough*, National Research Corp., who spoke on "Vacuum Evaporated Coatings for Corrosion Resistance." Slides were shown to illustrate the talk and, after a question and answer period, Mr. Clough was given a vote of thanks for his interesting and informative talk.

Christopher Marzano
Publicity Chairman

Los Angeles Branch

The branch devoted its last meeting of 1959, held Dec. 9 at Rodger Young Auditorium in Los Angeles, to a program that brought the members up to date on latest developments in the rockets and missiles field. Librarian *Marjorie E. Farmer* presented a program that included three films dealing with atomic power, missile test and development, and the problem today's scientists face in their battle to conquer outer space.

The meeting was attended by 80



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members and guests, with *George Hetz*, branch president, in the chair. *Frank Virgil*, reporting for absent *Earl Arnold*, announced that Arnold (educational chairman for the 1960 convention) had attended a meeting of the A.E.S. executive board in Detroit earlier in December. Virgil reported that Arnold brought back the national board's complete approval of 1960 convention arrangements being made under the direction of local general chairman *Tony Stabile* and co-chairman *Hetz*.

Hetz announced that arrangements for the 1960 convention are somewhat ahead of schedule and that no major hitch is evident at this time in respect to either the business, educational, or entertainment phases of the Los Angeles conclave.

President Hetz initiated seven applications for membership. These were *W. M. Padilla*, *Glen E. LeBeck*, *Paul S. Rodenbacher*, *E. N. Teljohn*, *William M. Cambridge*, *Milton Cohen* and *Robert B. Dutton*. A plan initiated not long ago of permitting proxies to represent absent applicants is working

out well, Hetz reported, and has eliminated the delays in initiation previously encountered when applicants had to be present for induction.

The seven new members accepted on December 9 brought the branch's year-end membership total to 337, according to Secretary *Harvey K. Hunt*.

Guests attending the December meeting included *Thomas J. Scavarda* of Trophycraft Co.; *Jack Quintana* of Pacific Scientific Co.; and *Donald Crane* of Kimball Research Co. It was announced that Quintana, a member-at-large, is arranging for change of membership to Los Angeles Branch.

Metal Finishing Suppliers' Ass'n

The board of trustees and members of various committees held the annual Eastern Interim Meeting at the Hotel Robert Treat in Newark, N. J. December 12, 1959. The meeting was called to order at 2:15 p.m. by President *Ray Ledford*. Progress reports were given by officers and committee chairmen; much time was devoted to discussion of old and new business plus suggested plans and policies regarding the role

which the MFSA plays in annual branch banquets and the annual American Electroplaters' Society conventions.

As in the past, nothing was finalized at this meeting since it is customary to table such matters until ratified at the midwest meeting, which was to be held in Chicago January 30, 1960. Those in attendance were as follows: *R. S. Ledford* (Chicago), president; *J. G. Carrique* (Montreal), 2nd vice president; *H. L. Kellner* (New Haven), 3rd vice president; *E. A. Blount* (Cincinnati), treasurer; *E. W. Couch* (Waterbury), past president; *A. P. Munning* (Newark), executive secretary; *E. L. Combs* (Cleveland), *H. J. McCracken* (Detroit), *R. M. Norton* (Matawan) and *J. E. Trumbour* (Westwood), trustees; *M. Glover* (Boston) and *J. Duffy* (Philadelphia), committee chairmen.

Proxies were received from *F. P. Green* (Elk Grove Village, Ill.), 1st vice president; *L. A. Davies* (St. Louis) and *A. B. Hoefer* (Detroit), trustees, who were represented by *H. D. McLeese* and *S. M. Goble* of New York and *C. Helmle* (New Haven).

13

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The meeting adjourned at 5:45 p.m., after which the group attended a cocktail party, hosted by the following concerns: *Enthone, Inc.*; *Frederick Gumm Chemical Co., Inc.*; *Hanson-Van Winkle-Munning Co.*; *Sel-Rex Corporation*; and *Udylite Corporation*, under the auspices of the MFSA. Later, an enjoyable evening was spent at the annual Christmas Party of the Newark Branch of the A.E.S. attended by approximately 375 people.

John E. Trumbour,
Publicity Chairman

Upper Midwest Metal Finishing Assn.

The Upper Midwest Metal Finishing Association met on Monday evening, January 4th, 1960 at 7:00 p.m. at Jax Cafe in Minneapolis, Minn. There were 40 members and guests attending this meeting, which was the highest turnout the group has ever had for a January meeting, especially considering that the meeting was held following a heavy snow fall and —15° weather.

Four new members were welcomed into the group, namely: *Joseph Dugas* of *Cornelius Co.*, *Thomas Bolduc* of *In-*



E. H. Ehlert on left and John M. Sliney.

dustrial Tank Lining Co., *Fred Rieger*, director of research at *Josten Mfg. Co.* in *Owatonna, Minn.*, and *Robert Ziegewied* of *Wyandotte Chemicals Corp.* An announcement was made advising members that they would be receiving *METAL FINISHING* magazine as a part of their membership on an annual subscription basis which was very well received.

Following a steak dinner, the meeting was turned over by President *Carl*

Ahlgren to Branch Librarian *Arthur Wendell*, who introduced Messrs. *E. H. Ehlert*, Western region manager and *John M. Sliney*, field engineer, for *Detrex Chemical Industries*.

Mr. Ehlert presented a most interesting and informative talk on "Use of Sonics in Metal Cleaning," incorporating in his talk the use of descriptive slides as well as setting up demonstration equipment incorporating the use of both high and low frequency ultrasonic equipment for use in connection with either solvent degreasing operations or alkaline cleaning compounds. Following the talk, a demonstration of the equipment was held which aroused a considerable amount of enthusiasm, viewing on the part of those present and questions being asked. Following Mr. Ehlert's talk he was presented a necktie on the part of the group as a token of its appreciation.

Following the paper by Mr. Ehlert the results of the officer elections which were held at the December 7th meeting was announced, with the following members to serve as officers for the 1960 year: President, *Carl Ahlgren* of *Hawkins Chemical Co.*; 1st Vice Presi-



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dent, *Leo B. Ebner* of Superior Plating, Inc.; 2nd Vice President, *Bernard Olson* of Remington Rand Univac; Secretary-Treasurer, *Robert L. Buckley* of Industrial Chem. & Equip. Co.; Librarian, *Arthur Wendell* of the United States Air Force; Board of Directors, Messrs. *Cort Platt* of Precious Metal Platers, Inc., *Warren Johnson* of Mpls. Honeywell Regulator Co., and Past President, *E. H. Lindemann* of Mpls. Honeywell Regulator Co.

Robert L. Buckley
Secretary-Treasurer

N.A.M.F.

G. David Zeile, Jr., of the law firm of *Ashman, Zeile & Portmann*, Cleveland, Ohio, has been named legal counsel for the *National Association of Metal Finishers*. The need for competent legal counsel has been felt for quite some time, particularly in the past several months with a stepped up program of membership and industry services such as the Management Manual, ethical practices, standard procedures, and many other projects requiring legal clearance. Atty. Zeile has also rendered important counsel in the current Pennsylvania job plating industry court case.

Mr. Zeile attended public schools in Cleveland. He received his Bachelor of Arts degree from Ohio U. in 1948, and his Bachelor of Law degree from West-ern Reserve U. in 1950.

He is a member of the Cleveland Bar Association and a member of the Order of Coif, an honorary Law society; Cleveland Kiwanis Club; PTA; Euclid BPOE; Phi Kappa Tau; and Phi Delta Phi. A World War II veteran, Zeile served as an aviation cadet with the U. S. Navy, 1943-46.

The 33-year-old barrister is also

executive secretary of the NAMF affiliate in the Cleveland area, the Ohio Association of Metal Finishers, and has served in that capacity since 1953.

Committees Named

Two key committees were named last month. The educational committee is responsible for over-all educational activities of the association, including the *Management Manual* project, and surveys on operating costs and wage and salary structures.

Industry practices, trade customs, and the formulation of an industry code of ethics are the responsibility of the standard and ethical practices committee.

The committees are:

Educational — *Edward N. Marlette* (Marlette Plating Co., Buffalo), chairman; *Glenn H. Friedt, Jr.* (United Platers, Inc., Detroit), vice chairman; *A. T. Leonard* (Superior Plating, Inc., Minneapolis); *William R. Crawford* (Chrome-Rite Co., Chicago); *William Carlson* (Arrow Plating Co., Chicago); and *Jules Horelick* (Allied Metal Finishing Co., Baltimore).

Standard and ethical practices — *John T. Hyduke* (Durable Plating Co., Cleveland), chairman; *Stephen P. Palisin* (Empire Plating Co.), *Raymond Kuehne* (General Hard Chrome Co.), *Duke L. Saas* (Atlas Hard Chrome Service), *Joseph Kopernak* (J & R Plating and Polishing Co.), *William J. Higgins* (Manufacturers' Plating Co.), and *William J. Karkut* (Dun-Well, Inc.), all of Cleveland.

Federation of Paint and Varnish Changes Name

The Federation of Paint and Varnish Production Clubs has changed its name to the Federation of Societies for Paint

Technology. Headquarters remain at 121 S. Broad St., Philadelphia 7, Pa.

NEW BOOKS

Chemical Engineering Catalog

Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1960. 1680 pages.

The forty-fourth annual edition of this guide for buyers of process equipment is available without charge to users of engineering materials and apparatus. The catalog is indexed by company name, functions, equipment and materials of construction, engineering services, and trade names. The engineering services index includes a list of companies who have pilot plant facilities and laboratories.

As usual, this large volume continues to include the most recent developments in equipment, and serves as the leading source of information on products and services.

Surface Treatment and Finishing of Aluminum and Its Alloys

By S. Wernick & R. Pinner. Published by Robert Draper Ltd., 85 Udney Park Road, Teddington, Middlesex, England. 1959. 578 pages plus appendix and index. Price: \$13.25 postpaid.

Although the first edition of this comprehensive compilation of information on the subject appeared less than four years ago, new developments in the field have been so numerous that the authors have had to add many new sections as well as to revise the original text completely.

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have at hand the most recent data on such diverse and important subjects as hard anodizing, bright dipping, conversion coatings, vitreous enameling, etching, and polishing. The tables on alloys and dyes have been revised extensively, while other sections of the book have received minor changes where required.

This second edition continues to be the only authoritative volume on finishing aluminum, and is of immediate practical value because it not only lists references but describes the commercial methods in sufficient detail so that the metal finisher need not investigate the literature further, except in special circumstances.

OBITUARIES

HAROLD M. SHONBERG

Harold M. Shonberg, president of Alpha Metals, Inc., Jersey City, N. J. and the Alpha-loy Corp., Chicago, Ill., was one of five people killed Saturday, December 5, at Palm Desert, Calif., when the small plane in which he was being given a demonstration flight so that he might consider purchasing it for his company, collided in the air



Harold M. Shonberg

with another private plane. He was 49.

All four occupants of the other plane were killed. The pilot and other occupant of the plane in which Mr. Shonberg was a passenger were hospitalized.

Mr. Shonberg travelled extensively for business reasons and had been in California for several days seeking a location for a larger branch plant. He started his firm in 1930, having previously taken over I. Shonberg, Inc., a company founded by his grandfather in 1871 as a metal refinery, then reorganized by his father, in 1912, as Standard Rolling Mills, Inc.

Mr. Shonberg was a mechanical engineer, graduating from Brooklyn Polytechnic Institute in 1930. In 1956, he was honored as "an outstanding graduate" with the Institute's Certificate of Distinction for his contribution to "Science and Engineering for Human Well-Being."

Surviving are his widow, Rena, his daughters Judy and Irene, his mother, Corinne Shonberg, a brother, Joseph Shonberg and a sister, Helen Isaacson.

JOHN C. PANGBORN

John C. Pangborn, co-founder of Pangborn Corp., died at his home in Hagerstown, Md. on Christmas Eve. Prominent Catholic layman, industrialist and civic leader, Mr. Pangborn was 75 years old.

He was born in Leroy, Minn. and, along with his brother Thomas W. Pangborn, founded the well known blast cleaning and dust control manufacturing concern in New York City in 1904. The company and its management moved to Hagerstown in 1912. For many years he was active in sales,

becoming widely acquainted in American industry. In recent years he has served as vice chairman of the board of directors and of the Pangborn Foundation.

During his lifetime of philanthropy and service Mr. Pangborn received many awards including honorary Doctor of Laws degrees from St. Vincent's College, Latrobe, Pa. and Mount St. Mary's College, Emmitsburg, Md. He was a member of the Rotary Club, Elks, Holy Name Society and a Fourth Degree Knights of Columbus.

In 1956 he became a Papal Knight of Malta, an honor bestowed on him by the late Pope Pius XII.

A Solemn Pontifical Mass of Requiem was sung with the Most Reverend Jerome D. Sebastian, Auxiliary Bishop of the Baltimore Archdiocese, as Celebrant. Many church and state dignitaries attended his funeral on December 28.

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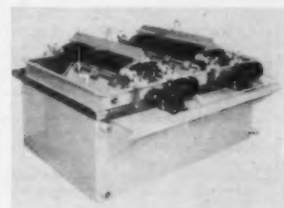
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- 1—500 AMPERE, 25 VOLT. CHANDEYSSON, Synchronous, Exciter-in-head.
- 2—400 AMPERE, 40 VOLT. M.G.C., Separately Excited.

RECTIFIERS

- 1—G. E. 2000/1000 AMP., 6/12 V.
- 1—SEL-REX SELENIUM, 1200 AMPS 9 V. for 440/3/60.
- 1—THER 1500 AMP., 6 VOLT DC for 220/3/60 AC Remote Control.
- 1—1500/750 AMPERE, 6/12 VOLT, UDYLLITE-MALLORY.
- 1—RICHARDSON-ALLEN 1000 AMP., 9 VOLT DC for 220/3/60 Remote Control.
- 1—NEW G. E. 2000/1000 AMPS, 6/12 V. Remote Control 440/3/60 AC.

SPECIAL

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- 1—MERCIL Ball Burnishing Barrel, Size 1.
- 3—LASALCO Ball Burnishers, Sizes 1, 2 & 4. Line-1 or unlined.
- 1—L'HOMMEDIEU 5 H.P. Variable Speed Buffer, Model 18.
- 1—INDUSTRIAL RDR-1 Rubber-Lined Filter, Size 14x28.
- 10—BUFFING LATHES — HAMMOND, DIVINE, U. S. etc. from 3 H.P. to 20 H.P.
- 2—INDUSTRIAL Type SC Filters for Cyanide. 18x48 and 18x36.
- 4—STEVEN-BADER Abrasive Belt Polishers.
- 3—AMERICAN Blower Type HS Fans, Size 330-10.
- 10—DUSKOP Dust Collector Cabinets, Sizes No. 550, No. 850, No. 1100.
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- 3—Udyllite rectifiers 1500/750 amp. 6/12 V.
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- 3—G. E. 500 amps. 6 volts with control.
- 1—Rapid 300 amps. 6 volts with control.
- 1—Udyllite 500 amps. 6 volts with control.

SEMI-AUTOMATIC PLATING MACHINES

- 5—From 12' to 32' long for nickel and cyanide.

PLATING BARRELS

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- 3—Lasalco steel 36 x 18 Lucite cylinder.
- 1—Lasalco rubber lined 30 x 15.
- 1—H-VW-M steel 36 x 18.
- 1—Udyllite steel—42 x 15.
- 2—Udyllite multi-purpose barrel — hard rubber cylinder.

FILTERS

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- 2—Abbott barrels, variable speeds.
- 1—#2H Baird polioaction Tumbler.
- 10—Baird barrels 2C tilting type.
- 8—Henderson barrels 5A tilting type.
- 4—Globe barrels.

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- 4—#101 Tandum 15 H.P.
- 2—Production Machine #484-2.
- 5—Acme A2.
- 3—Acme B10.
- 2—Divine Model VM-10 — 10 H.P.
- 2—L'Homedieu 5 H.P. variable speed.
- 15—Holland 5 H.P. — 7 1/2 H.P. — 10 H.P.
- 1—Acme L-82 — 7 1/2 H.P.
- 4—Gardner 5 H.P. — 7 1/2 H.P.
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- 2—Barrett centrifugal dryers.
- 2—Kroeder #12 steam explosionproof mtrs.

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- 1—Philips electric degreaser.
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- 1—Blakeslee washer.

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- 1—Marsche 5 HP. Swing Frame Grinder.
- 1—Admiral 2 HP. Grinder.
- 1—Viking 10 HP. Disc Grinder.
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- 1—C-6 Porter Cable, Wet or Dry Sander.
- 1—Pearless 10" Heavy Duty Sander.
- 1—Curtis 3 Wheel Polisher Type Sander.

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- 4—Masterson Floor Type.
- 2—Jones Double Wheel Idlers.
- 6—Divine Floor Type.
- 8—Wall Type Idlers.

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- 5—1/3-1/2 HP. Double Ends, Motor in head.

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- 4—Bench & Floor Type

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- 6—Cincinnati-Torit 1/2 to 1 1/2 HP. Units.
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- 2—8" Cyclones Complete.
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- 2—Roto Clone 5-7 1/2 HP. Wet type dust collector.
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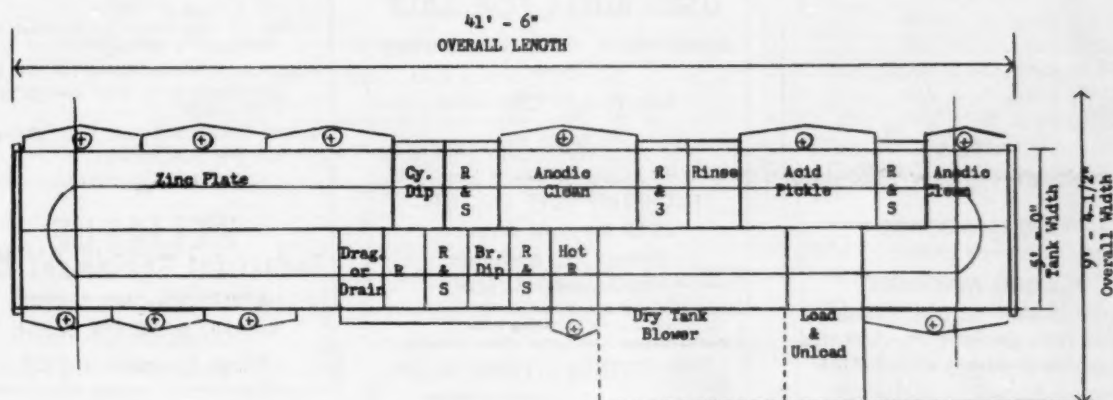
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- 1— 6 Volt — 7,500 Amps.
- 1— 6 Volt — 6,000 Amps.
- 1—18 Volt — 5,000 Amps.
- 1— 7 Volt — 5,000 Amps.

RECTIFIERS

- 1—1000 Amp. 0- 6 Volt
- 1—1000 Amp. 0-12 Volt
- 1—1500 Amp. 3-12 Volt
- 1—1500 Amp. 0- 6 Volt
- 1—2000 Amp. 0- 6 Volt

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- 2—18x48x40 Type SCW-2 — Industrial
- 1—54x36x30 Type SCWB2
- 1—2 ton Frostrade chiller

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We have several of the above machines located in Midwest. Pried Right, Available Immediately.

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333	30	G. E.
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940	32	Elec. Prod.
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1000/500	12/24	H-V-W
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1500	30/50	Century
1500	40/65	G. E.
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1500	70	Century
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5000/2500	6/12	Columbia

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Industrial, 10x28 RDR-2.
Industrial, 14x28 SCW-2.

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20-ft. nickel HVW.
18-ft. copper HVW.
18-ft. chrome HVW.

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Industrial, one, two and four tube systems with duriron pumps and motors.

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3—Crown 200 Ampere units.
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Du Pont de Nemours & Co., E. I. Wilmington 98, Del.		Metal Finish, Inc. 410 Frelinghuysen Ave., Newark, N. J.	38	Worthy Products Co. Box 123, Temple, Pa.	120
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Electro-Glo Co. 621 S. Kolmar Ave., Chicago 24, Ill.		Michigan Buff Co., Inc. 3503 Gaylord Ave., Detroit 12, Mich.	120	Zialite Corp. 92 Grove St., Worcester 5, Mass.	
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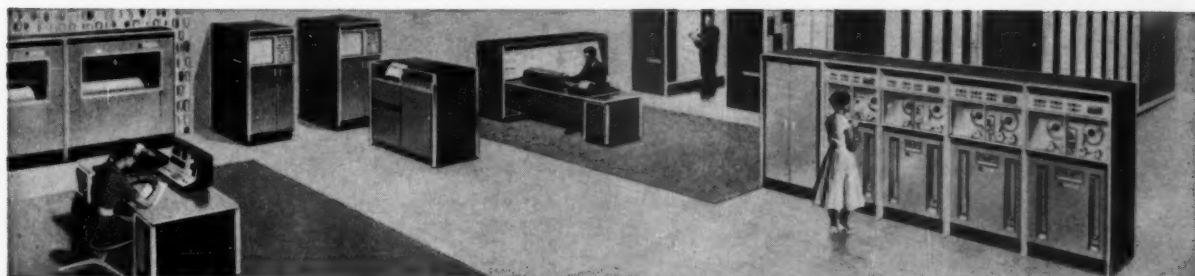
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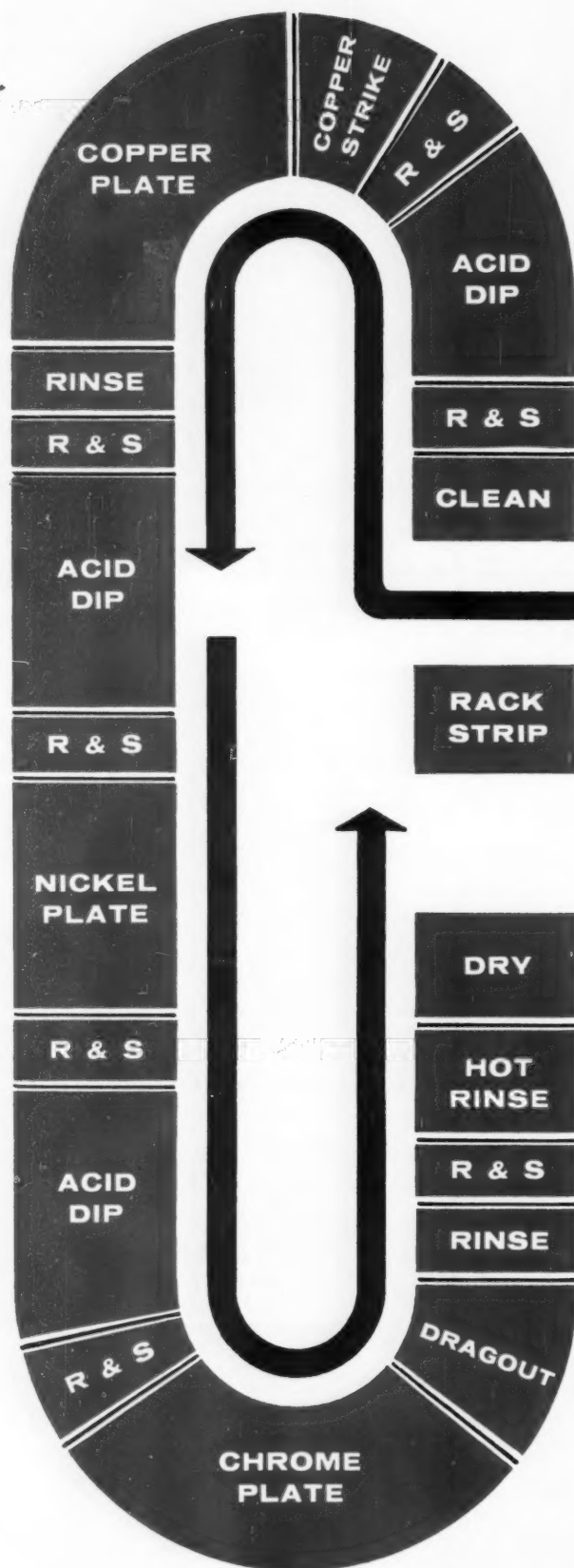
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